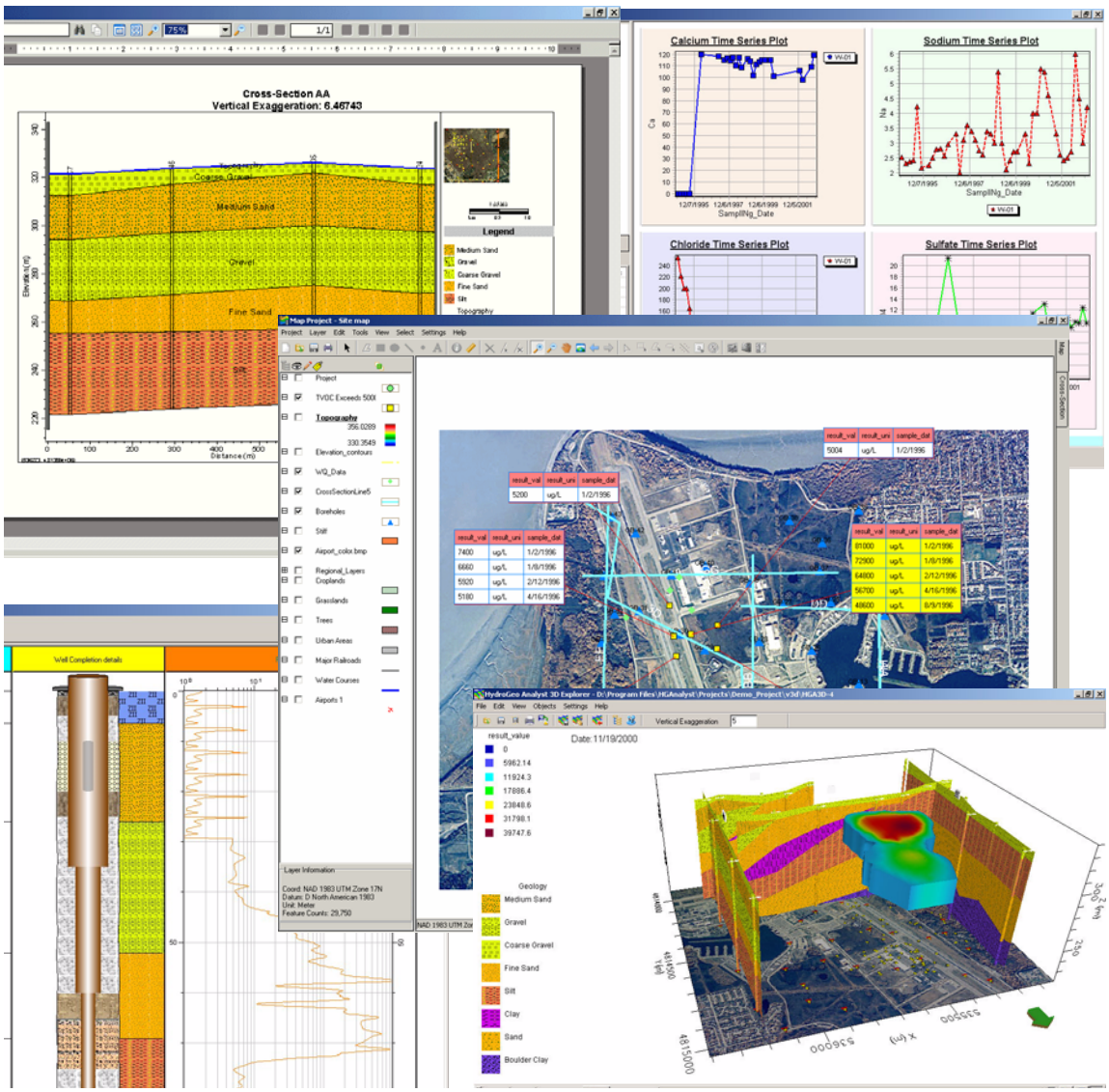
HydroGeo Analyst v.4.0 User's Manual

Database Utilities, Borehole logging/reporting, 2D Mapping and Cross Sections, and 3D Visualization



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Preface

Schlumberger Water Services (SWS) is a recognized leader in the development and application of innovative groundwater technologies in addition to offering expert services and professional training to meet the advancing technological requirements of today's groundwater and environmental professionals.

Waterloo Hydrogeologic Software (WHS), developed by SWS, consists of a complete suite of environmental software applications engineered for data management and analysis, modeling and simulation, visualization, and reporting. WHS is currently sold globally as a suite of desktop solutions.

For over 18 years, our products and services have been used by firms, regulatory agencies, and educational institutions around the world. We develop each product to maximize productivity and minimize the complexities associated with groundwater and environmental projects. To date, we have over 14,000 registered software installations in more than 85 countries!

Need more information?

If you would like to contact us with comments or suggestions, you can reach us at:

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Obtaining Technical Support

To help us handle your technical support questions as quickly as possible, please have the following information ready before you call, or include it in a detailed technical support e-mail:

- A complete description of the problem including a summary of key strokes and program event (or a screen capture showing the error message, where applicable)
- Product name and version number
- Product serial number
- Computer make and model number
- Operating system and version number
- Total free RAM

- Number of free bytes on your hard disk
- Software installation directory
- Directory location for your current project files

You may send us your questions via e-mail, fax, or call one of our technical support specialists. Please allow up to two business days for a response. Technical support is available 8:00 am to 5:00 pm EST Monday to Friday (excluding Canadian holidays).

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E-mail: sws-support@slb.com

Training and Consulting Services

Schlumberger Water Services offers numerous, high quality training courses globally. Our courses are designed to provide a rapid introduction to essential knowledge and skills, and create a basis for further professional development and real-world practice. Open enrollment courses are offered worldwide each year. For the current schedule of courses, visit: www.swstechnology.com/training or e-mail us at: sws-training@slb.com.

Schlumberger Water Services also offers expert consulting and peer reviewing services for data management, groundwater modeling, aqueous geochemical analysis, and pumping test analysis. For further information, please contact sws-services@slb.com.

Waterloo Hydrogeologic Software*

We also develop and distribute a number of other useful software products for the groundwater professionals, all designed to increase your efficiency and enhance your technical capability, including:

- Visual MODFLOW Premium
- HydroGeo Analyst
- Aquifer Test Pro
- AquaChem
- GW Contour
- UnSat Suite Plus
- Visual HELP
- Visual PEST-ASP

Visual MODFLOW Premium

Visual MODFLOW Premium is a three-dimensional groundwater flow and contaminant transport modeling application that integrates MODFLOW-2000, SEAWAT-2000, MODPATH, MT3DMS,

MT3D99, RT3D, VMOD 3D-Explorer, WinPEST, Stream Routing Package, Zone Budget, MGO, SAMG, and PHT3D. Applications include well head capture zone delineation, pumping well optimization, aquifer storage and recovery, groundwater remediation design, simulating natural attenuation, and saltwater intrusion.

HydroGeo Analyst

HydroGeo Analyst is an information management system for managing groundwater and environmental data. HydroGeo Analyst combines numerous pre and post processing components into a single program. Components include, Project Wizard, Universal Data Transfer System, Template Manager, Materials Specification Editor, Query Builder, QA/QC Reporter, Map Manager, Cross-Section Editor, HGA 3D-Explorer, Borehole Log Plotter, and Report Editor. The seamless integration of these tools provide the means for compiling and normalizing field data, analyzing and reporting subsurface data, mapping and assessing spatial information, and reporting site data.

AquiferTest Pro

AquiferTest Pro, designed for graphical analysis and reporting of pumping test and slug test data, offers the tools necessary to calculate an aquifer's hydraulic properties such as hydraulic conductivity, transmissivity, and storativity. AquiferTest Pro is versatile enough to consider confined aquifers, unconfined aquifers, leaky aquifers, and fractured rock aquifers conditions. Analysis results are displayed in report format, or may be exported into graphical formats for use in presentations. AquiferTest Pro also provides the tools for trends corrections, and graphical contouring water table drawdown around the pumping well.

AquaChem

AquaChem is designed for the management, analysis, and reporting of water quality data. AquaChem’s analysis capabilities cover a wide range of functions and calculations frequently used for analyzing, interpreting and comparing water quality data. AquaChem includes a comprehensive selection of commonly used plotting techniques to represent the chemical characteristics of aqueous geochemical and water quality data, as well includes PHREEQC - a powerful geochemical reaction model.

GW Contour

The GW Contour data interpolation and contouring program incorporates techniques for mapping velocity vectors and particle tracks. GW Contour incorporates the most commonly used 2D data interpolation techniques for the groundwater and environmental industry including Natural Neighbor, Inverse Distance, Kriging, and Bilinear. GW Contour is designed for contouring surface or water levels, contaminant concentrations, or other spatial data.

UnSat Suite Plus

UnSat Suite Plus seamlessly integrates multiple one-dimensional unsaturated zone flow and solute transport models into a single, intuitive working environment. Models include SESOIL, VS2DT, VLEACH, PESTAN, Visual HELP and the International Weather Generator. The combination of models offers users the ability for simulating the downward vertical flow of water and the migration of dissolved contaminants through the vadose zone. UnSat Suite Plus includes tools for project management, generating synthetic weather data, modeling flow and contaminants through the unsaturated zone, estimating groundwater recharge and contaminant loading rates, and preparing compliance reports.

Visual HELP

Visual HELP is a one-dimensional, unsaturated zone flow modeling application built for optimizing the hydrologic design of municipal landfills. Visual HELP is based on the US E.P.A . HELP model (Hydrologic Evaluation of Landfill Performance) and has been integrated into a 32-Bit Windows application. It combines the International Weather Generator, Landfill Profile Designer, and Report Editor. Applications include designing landfill profiles, predicting leachate mounding, and evaluating potential leachate seepage to the groundwater.

Visual PEST-ASP

Visual PEST-ASP combines the powerful parameter estimation capabilities of PEST-ASP, with the graphical processing and display features of WinPEST. Visual PEST-ASP can be used to assist in data interpretation, model calibration and predictive analysis by optimizing model parameters to fit a set of observations. This popular estimation package achieves model independence through its capacity to communicate with a model through its input and output files.

1

Introduction to HydroGeo Analyst

HydroGeo Analyst is the most comprehensive, and yet easy-to-use, environmental data management system, providing data validation, analysis, and visualization. The HydroGeo Analyst package integrates a list of flexible and customizable database structures used around the world, complimented by state-of-the-art tools for data interpretation, statistical analysis, GIS mapping, data charting, and two- and three-dimensional visualizations.

For most environment-related projects, whether they are contaminated sites or municipal water supply projects, there is often an abundance of data that has been collected over the years. How many times have you had to sift through several paper reports for that one piece of information when compiling monthly summaries on a project? Can you be sure that you have not misplaced a report or failed to mention an important piece of data?

The HydroGeo Analyst package addresses these and many other needs in the industry. The system enables you to create a project specific database, or enhance and build upon your existing database. It can collect all of your previous data and reports and consolidate them into a powerful relational database system that can be queried and referenced with ease.

HydroGeo Analyst (also referred to as HG Analyst, or HGA) operates as a desktop application based on Microsoft SQL Server technology. The package supports multiple user levels, for controlled data management, with structured access privileges for setting up project data structures, checking out data to working sub-projects, and submitting new or modified data.

Sample Applications

Typical applications for HydroGeo Analyst include:

- Regional water well management
- Contaminant site inventory
- Regulatory compliance
- Geologic cross-sections
- Public access to information

- Environmental site assessment
- Monitored natural attenuation
- Regional aquifer characterization and management
- Cross-boundary data sharing
- Aquifer vulnerability mapping

1.1 What's New in HydroGeo Analyst

The main interface for HydroGeo Analyst has much of the same user-friendly look and feel as the previous version, but with some significant improvements to features. Some of the more significant upgrade features in the latest versions of HydroGeo Analyst are described below.

1.1.1 New Features in v.4.0

The following new features are available in v.4.0:

Map Manager GIS

- Detailed legend for layers with graduated or value rendering
- Detailed label rendering for contours
- Allow restricting contour lines within a polygon
- Create contours using only selected stations
- Create map layers from an intersection of two other layers
- Display time series plots linked to stations on a map
- Allow creating map layers with Arabic attributes
- Display graticule on map
- Allow creating color shaded/zones map layers, with option to clip color shading at the boundary of a polygon
- Load surfaces such as DEM, Surfer GRD, ESRI GRD
- Define cross-section line from existing polyline layer
- Pan/Zoom when digitizing a cross-section line
- Snap cross-section line to stations when digitizing a line
- Modify buffer distance for existing cross-section lines
- Georeference raster images using more than two control points
- Group map layers
- Support for datum shifts

Cross Section Editor

- Show vertical axis on exported image of cross section
- Ability to rearrange order of legend elements
- Adjust vertical axis in cross-section
- Adjust vertical exaggeration in cross-section

- Automatically insert vertices along the model layers
- Replace basic topographic representation with detailed high-resolution Surface elevations from DEM, Surfer GRD, ESRI GRD files.

Borehole Log Plotter

- Improved, restructured graphical user interface
- Allow multiple casings/piezometers within a well, and display on BHLP
- Improved display settings such as the ability to use image pattern or image for 2D/3D casing.
- Support for reducer pipe fittings on well casing
- Display annular fills in boreholes and between piezometers.
- Enable/Disable live update
- For plot columns
    - Allow superimposing several graphs sharing one vertical axis
    - Added options to show plot axis, primary and secondary scales (log or normal), define the range for horizontal axis (mix, max, interval),
    - Show gridlines from the primary or secondary scale
    - Adjust label settings
    - Display a legend for the plot series.
- Improved options for displaying water levels on the BHLP
    - Show min, max, earliest/latest observed sample
    - Show average water level
    - Customize water level symbols and labels

Time Series Charting

- Display time series graphs as bar charts
- Display X-axis data in various date/time formats
- Advanced color classification and graduated color options for bar charts

Integration with SWS products

- Export data to AquiferTest for pumping test analysis
- Export data to AquaChem for water quality analysis
- Import datalogger data from MON files

General

- Improved environmental-imperial/metric database templates
- Improved data display for Interpretation Results
- Revised and updated demo project
- More unit options for storing field and lab data
- Support for more image export formats in 3D explorer

1.1.2 New Features in v.3.0

The following new features are available in v.3.0:

Data Management

Crosstab Queries

- Generate advanced crosstab queries from data queries
- Format columns, rows, sorting options, display (color, font) settings
- Send crosstab query to a report or export to HTML and EXCEL
- Display results with statistical functions: Sum, Count, Average, Max, Min, Standard Deviation, Standard Deviation Population, Variance, Variance Population

Quality Control (Lab Quality Assessment)

- Define one or more lab quality assessment templates
- Analyze Duplicate, Spiked and Blank samples
- Compare Relative Percent Difference and Coefficient of Variation for Duplicate samples
- Analyze Percent Recovery for Spiked samples
- Compare Blank samples to method detection limits
- Execute a Quality analysis on a selected dataset
- Display and retrieve assessment results; records not meeting assessment criteria will be highlighted with user-defined colors for each QC check
- Save assessment results to a MS Excel spreadsheet

Time Series Charting

- Create Time Series X-Y plots based on data queries
- Add legends and data marker labels to plots
- Add best fit, trend, formula, or statistical lines to the plot
- Display non-detect, uncertainty, or detection limits on the plot, as lines or symbols
- Display one or more water quality standard values, as a line or symbol, for quick detection of samples that exceed the standards
- Define data series ranges, and modify display properties for different data ranges (e.g. define a data range where the data exceeds the water quality standard values, and assign unique symbol, line, and display properties for this data)
- Interact with plots, and display multiple plot windows in the viewer window simultaneously
- Select fields for plot grouping or data series grouping
- Print plots in a report, single or multiple pages

- Save plot settings as templates for re-use
- Export plots to graphics format or copy plots to Windows clipboard

Application and Project Management

User Access Level Management

- Manage access rights on an application and project level
  - Application Level - used to control permissions to features such as creating new projects and deleting existing ones; and
  - Project level - used to control access to individual projects and the various modules; e.g. Data access, maps, queries, BHLP, Template Manager, etc.
- Create and manage user groups (i.e. create, edit, delete, user groups, and add, remove, edit, users in to existing user groups)
- Project administrator can assign access rights to User Groups, for each object (Data Management, Maps, Cross-Sections, etc.)
- Set user ID for Users, names, description, and access passwords
- Enforcement of access levels to each user group as per the specified security document
- Store Users and User Groups in database templates, for re-use in future projects.

GIS Map Manager

- Add or remove stations from existing cross-sections
- Display summary results on map, in a tabular format:
  - modify display properties of table (color, style, fields)
  - define conditions, and highlight values that violate a specified value or a value from another field (e.g. useful for highlighting contaminant exceedences)

Cross-Section Editor

- Remove wells from cross-sections
- Create new annotation layers (text, line, polygon); this allows adding text labels, shapes, or lines that can that can represent faults
- Improved data management for cross-section interpretations
  - Interpretations are saved to the database
  - Interpretation results are now linked to the stations that were selected for the cross-section; these stations, along with their interval data, are saved to the database
  - Interpretation results, and the wells and corresponding interval data, can be retrieved later using Query Builder.
- Display borehole log plots (BHLP) directly on cross-sections (e.g. display

Geophysical plots on the cross-section, to assist in the interpretation)

Borehole Log Plotter

- Print borehole log plots to a user-defined scale, when a report is generated
- Use queries as data sources for depth, interval, or plot columns; provides for flexible data sources
- Reorder columns by dragging and dropping in the designer view
- Allow zooming into any specified interval of a BHLP
- Added BHLP designs (templates) that are widely used around the world;
    - US Army Corps of Engineers
    - Standard Environmental Monitoring Well
    - Geophysical / Water Supply
    - Geotechnical Drilling Log
    - Ontario MOT Record of Borehole

HydroGeo Analyst 3D-Explorer

- 3D Interpolation of a data source
    - Specify grid dimensions and extents
    - Select interpolation method: Kriging or Inverse Distance
    - Generate static or transient plumes, for one or more contaminants
- 3D Plume display
    - Display Plumes (Static and Transient) using Isosurface, Color map, or and/or Isoline Map:
    - Display 3D volume estimation based on the isosurface value
    - Save Plume animation to .AVI file.d
- A number of defects were addressed since v.1.0

1.1.3 New Features in v.2.0

The following features were added in Version 2.0:

Data models

- New database templates. All database templates are now provided in both metric or imperial length units
- Database fields now support images, in all data categories

Data Transfer System (DTS)

- Source files require only the Station names. It is no longer necessary to add numeric station ID's to each record in your source table
- A number of map projection systems have been added

Map Manager

- Improved options for contouring including user-defined contour intervals
- Added Kriging and Inverse Distance interpolation methods for creating contour maps and gridded data sets
- A number of map projection systems have been added

Cross-Section Editor

- You can now display gridlines to aid in the interpretation
- Dummy wells can be displayed at intersecting cross sections, to aid in your cross-sectional interpretations
- When printing a cross section, a legend for the cross section wells can now be displayed

HGA 3D-Explorer

- You may display isolines (contour lines) for any surface that is included in the 3D project
- You may specify a cut-off for upper and lower contour values
- You may change the color from palette for surfaces

Query Builder

- You may display map ready queries in the project's projection system. When such queries are executed, X and Y coordinates are displayed in the current projection system

Borehole Log Plotter

- It is now possible to hide the well casing above ground surface (i.e. display a flush mount well casing)
- Improved reporting features including displaying of borehole names in report table of contents (TOC)
- Core logs (images) can now be added to borehole log plots from any image type field in the database

General

- It is now possible to delete unwanted HGA SQL Server databases
- A wide list of map projection systems have been added
- A number of defects were addressed since v.1.0

1.2 About HydroGeo Analyst

HydroGeo Analyst is implemented through a number of modules, each performing a specific task. This approach allows HydroGeo Analyst to be memory efficient, flexible, and expandable. In addition, with most of its data and settings implemented in the Extensible Markup Language (XML), there are unparalleled and unlimited possibilities to develop third-party components to work with the software.

Some of the modules that come with HydroGeo Analyst include:

- Data Transfer System
- Template (Database Schema) Manager
- Query Builder
- GIS Map Manager
- Cross-Section Editor
- Borehole Log Plotter
- Report Designer
- 3D Visualization

A brief description of each module is provided in the following sections, while a more detailed discussion is presented in later chapters.

1.2.1 Data Acquisition

Data Entry

Most environmental data is inherently spatial, as observations are taken at specific map coordinates over time. In HydroGeo Analyst, these sampling locations are referred to as **Stations**. HydroGeo Analyst comes with standard, easy-to-use data entry grids, equipped with drop-down combo boxes and many other features to facilitate data entry and validation for virtually any type of Station data.

Importing and Exporting Data

The Data Transfer System (DTS) is designed to assist in the process of importing/exporting data to/from the database. Using the DTS, station data can be imported from practically any source, including delimited text files, MS Excel spreadsheets, MS Access Databases, SQL Server Databases, and more.

1.2.2 Data Management

HydroGeo Analyst supports virtually any database structure, including those with multiple levels of relationships among two or more entities. This provides an unparalleled flexibility for projects that may have variable needs. For example, the project database structure may need to satisfy requirements of the United States

Environmental Protection Agency (US EPA) or Ontario's Ministry of the Environment (MOE).

For these and many other needs, HydroGeo Analyst comes with a number of customizable templates implementing various commonly used database structures. These structures include:

- Ontario's Ministry of Environment Water Well Information System (MOE - WWIS) (Metric Units)
- Ontario's Ministry of Environment Water Well Information System (MOE - WWIS) (Imperial Units)
- Generic Environmental (Metric)
- Generic Environmental (Imperial)
- US E.P.A. Region 2 (Metric)
- US E.P.A. Region 2 (Imperial)
- US E.P.A. Region 5 (Metric)
- US E.P.A. Region 5 (Imperial)

These templates also include commonly used and customizable data queries and report templates.

Template Manager

If your database needs cannot be satisfied through one of the database templates that are provided with HGA, you may use the Template Manager to create and customize your own database structure. The Template Manager is provided to handle such tasks as creating, editing, and importing database schemas for your project databases. It provides a set of categories that allows organizing your database tables. Existing database structures can also be imported using the Template Manager.

Customizable Lists and Standards

HydroGeo Analyst comes with a List Editor tool that allows users to create and customize lists for any field - allowing for rapid data entry. Common examples of lists include:

- List of over 150 standard Soil Classifications with descriptions and patterns
- List of common chemical names with their CAS numbers
- Lab analysis test methods
- Well drilling methods, construction, and casing materials
- County and State Codes
- Applicable standards for various purposes, regions, and agencies

A "List" in HydroGeo Analyst is equivalent to either a physical or virtual look-up table.

Data Querying and Filtering with the Query Builder

Data querying is an important feature for any environmental database. It provides the ability to easily locate desired information, with only a few mouse clicks.

HydroGeo Analyst provides multiple methods of querying data out of your database through the Query Builder. The Query Builder combines a set of tools for creating a range of simple, to the most advanced, queries for your projects. All queries created can be saved for later use, used to define Station Groups, or used to filter data for reporting, plotting charts, and creating GIS maps.

1.2.3 Data Visualization

Interpretation of geologic and hydrogeologic data is made easy with the visualization modules that are provided in HydroGeo Analyst. Using these tools, raw data can be transformed into meaningful spatial data sets. HydroGeo Analyst offers a collection of standard and custom modules for interpreting vast amounts of spatial data. Some of these modules are briefly described in the following sections.

Map Manager

The Map Manager, built on ESRI's MapObjects technology, provides a spatial view of any set of selected data. Basemaps of the site can be quickly imported, allowing for meaningful interpretation of borehole and well data. The Map Manager is designed in such a way that most files required for a desired map view are generated automatically. The Map Manager also provides a link to groundwater flow models such as Visual MODFLOW.

The true power of GIS is harnessed when it is used for spatial analysis of multiple data sets. These spatial data sets can be combined to provide:

- Groundwater recharge flux maps
- Aquifer yield capacity
- Aquifer vulnerability
- Contamination risk assessment
- Geologic cross-sections
- Completion diagrams

Contour Mapping

In addition to creating and displaying selected data on a map, the Map Manager also allows you to create contour maps and other thematic maps for any selected data from your database. For example, you can create and run a query that returns the maximum concentration of a given chemical over a certain period of time, and transfer the result to the Map Manager. Once the map with this data is created, you can create and view

contour maps depicting the distribution of the selected chemical concentration over the site area.

Thematic Mapping

A Thematic Map of any type of data may be created and displayed on the map view. Thematic maps include Pie and Bar charts, with options to customize their appearance and style.

Cross-Section Editor

Many geologic and/or hydrogeologic site investigations require a detailed analysis of the available lithological data, and the drafting and interpretation of cross sections. The Cross-Section editor can be used to perform these tasks.

The Cross-Section editor provides a set of easy-to-use tools to interpret subsurface data. Geological and hydrogeological interpretations, as well as interpretations geared towards creating model layers, can be created using the cross section module. All model interpretations can be exported for use as modeling layers in groundwater modeling software packages, including Waterloo Hydrogeologic's Visual MODFLOW.

The Cross-Section editor is seamlessly integrated with the HydroGeo Analyst 3D-Explorer, a tool that combines and displays one or more cross-sections in a 3D fence diagram view.

3D Subsurface Visualization with 3D Explorer

Once cross-sectional views of the data are created and preliminary interpretations made, 3D Explorer can be used to create fence diagrams containing one or more of those cross-sections. The 3D Explorer provides a unique perspective of the entire site through its ability to display multiple cross-sections simultaneously; this perspective is not possible when viewing individual 2D cross sections.

The 3D Explorer, in addition to displaying fence diagrams, can also be used to display surfaces for each layer involved in the interpretation. For example, a surface depicting static groundwater elevations over the site can be created and displayed in the 3D Explorer. Use the 3D Explorer to import basemaps, or shapefiles containing any type of data, and relate this to the cross-section interpretations. For example, a contour map or DXF site map may be draped or overlain on top of multiple fence diagrams. Finally, use the AVI recording tools to record the auto-rotation of the 3D fence diagrams for presentation purposes.

1.2.4 Reporting and Printing

Report Designer

HydroGeo Analyst features a state-of-the-art report generation tool that is equipped with a robust and easy to use runtime designer. A Report Wizard provides steps to simplify the report creation process; the results are high-quality and professional reports containing company headers/footers, and company logos. Reports can contain images and data from any module (Map views, cross-section views, 3D views, data grids, query results, charts, etc.) The final reports can be printed or saved in a number of formats including PDF, HTML, RTF, XLS, TIF, or TXT, as well as in a binary format.

Report Templates

The Report Designer includes several pre-defined Report Templates which can be used to quickly generate a professional report.

Borehole Log Plotting

Borehole log reports can be prepared using the Report Designer. A report for multiple boreholes can be generated at once by selecting one or more boreholes in the database and opening the borehole log report generator.

Borehole log reports may display information such as depth, lithology, water level, screen locations, sample results both as values and in charts, geophysical data, and more.

Chart Generator

HydroGeo Analyst comes with a powerful and easy-to-use charting interface that is closely linked to the reporting component. Unlimited numbers of charts can be placed on the reporting component's runtime designer. The charting control can then be linked to specific parts of the database to retrieve the source data. HydroGeo Analyst generates an unlimited number of pages with one or more charts with a single click of the mouse.

The charting module allows charts to include regulatory limits. As such, it allows users to define a range of values referred to as the "Alarm Zone" that may be used to indicate a range of values in exceedance of selected regulatory limits or intervals.

1.2.5 Interface to Visual MODFLOW and other WHI Software

ESRI GIS (*.SHP) files and databases have become two of the main sources of data for groundwater models, and HydroGeo Analyst makes it easier to incorporate these data formats directly into your model. HydroGeo Analyst allows you to export pumping well and observation well data directly to your model by mapping the required data to

the fields stored in the GIS shapefiles or the database. In addition, HydroGeo Analyst, through the use of the cross-section editor, enables you to create and export layers created from 3D Model interpretations of your geological data in the database.

You can directly link HGA station data with AquaChem and AquiferTest for in-depth water quality analysis and pumping test analysis, respectively. Also, HGA is now available as a conceptual groundwater model builder for FEFLOW.

1.3 Installing HydroGeo Analyst

1.3.1 System Requirements

Please refer to the HGA_Dongle_Install_Guide.pdf for details on the system requirements for HydroGeo Analyst.

If you have any problems with your particular system configuration, please make sure that you followed the installation instructions precisely. If the problem is still unresolved, contact your hardware experts. Finally, if you are still having trouble, see the section in Preface on **How to Contact Waterloo Hydrogeologic**.

1.3.2 Installation

Please refer to the HGA_Dongle_Install_Guide.pdf for details on the installation of HydroGeo Analyst. This file can be found on your installation CD ROM, or can be downloaded from the FTP site. The following is a brief excerpt.

HydroGeo Analyst must be installed on your hard disk before you can start to use the software. Please read the section on system requirements at the beginning of this section to ensure that your system meets the requirements before you start installing the software.

Place the CD into your CD-ROM drive and the initial installation screen should load automatically. Once loaded, an installation interface with several different tabs will be presented.

Please take the time to explore the installation interface, as there is information concerning other Waterloo Hydrogeologic products, our worldwide distributors, technical support, consulting, training, and how to contact us.

From the **Installation** tab, you may choose from the following two buttons:

- **HydroGeo Analyst** User's Manual
- **HydroGeo Analyst 4.0** Installation

The User's Manual button will display a PDF copy of the manual, which requires the Adobe Reader to view. If you do not have the Adobe Reader, a link has been created in the interface to download the appropriate software for free.

The Installation button will initiate the installation of the software on your computer. **HydroGeo Analyst** must be installed on your hard disk in order to run. Please read the section on hardware requirements at the beginning of this section to ensure that your system meets the requirements before you start installing the software. Ensure that you have administrative rights for the installation and software registration.

NOTE: If the installation interface fails to load automatically, you can:

- Open Windows Explorer, and navigate to the CD-ROM drive
- Open the Installation folder
- Double-click on the installation file to initiate the installation

Please follow the installation instructions, and read the on-screen directions carefully.

Although the HydroGeo Analyst Software needs to be installed on a local hard drive, the location of the database will depend on:

- the expected size of the data,
- the number of anticipated users, and
- data and system security

SQL Server 2005 Express can be installed on your hard drive as part of the installation process. If the WHI-SQL Express is installed, it will be setup as the default database server. SQL Server 2005 Express is a database engine built and based on core SQL Server technology.

NOTE: Previous versions of HGA have used Microsoft SQL Server Desktop Engine (MSDE) as their main SQL Server Engine. If you are upgrading from MSDE to the Microsoft SQL Express, please consider the following limitations when working with backup database files:

- You cannot open a backup database created by MSDE in a HGA environment that is using SQL Server Express.
- Likewise, you cannot restore a HGA project that is using SQL Server Express, with a backup database that was created with MSDE.

If you have used MSDE in the past and would like to continue using it, simply do not install SQL Express during the HGA 4.0 Installation.

Once the installation is completed, a shortcut icon will be placed on the desktop. You will be prompted to re-boot your computer for the system changes to take effect (this is necessary only if the WHI instance of SQL Express is installed).

1.3.3 Uninstalling HydroGeo Analyst

There may be instances where you will need to uninstall (remove) HydroGeo Analyst from your system (e.g. if the software is to be transferred to another computer, or if you need to reinstall it on the current computer).

Before uninstalling the HydroGeo Analyst software package from your system, we strongly recommend you to make backup copies of all your HydroGeo Analyst projects and databases. These include your entire HGA project folder and all its contents. Simply copy the Project directory, and its contents, to another directory. If you are also uninstalling the SQL Express component, make sure to also back up the SQL Server database(s) or else you risk permanently losing your HGA data. For more details, see “BackUp Database” on page 137.

To uninstall HydroGeo Analyst:

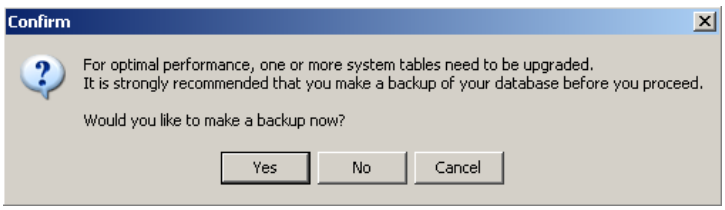
- Locate the **Add/Remove Programs** option in your **Windows’ Control Panel**.
- Select HydroGeo Analyst as the program to be removed
- Follow the on-screen instructions.
- Once you are finished, re-boot your system to ensure all system files are updated.

1.3.4 Starting HydroGeo Analyst

To launch HydroGeo Analyst, double-click on the desktop icon (as shown in the figure on the left), or by accessing **WHI Software > HydroGeo Analyst** from your **Start > Programs** Windows menu.

1.4 Updating Old Projects

HydroGeo Analyst v.4.0 is fully compatible with projects created in earlier versions. The first time you open a project from v.1.0, v.2.0 or v.3.0, you will be prompted to convert your database to the new format. A dialog similar to the one shown below will display.


Confirm
For optimal performance, one or more system tables need to be upgraded.
It is strongly recommended that you make a backup of your database before you proceed.
Would you like to make a backup now?
Yes
No
Cancel

At this time, you will have the option to create a back up copy of your database, which is highly recommended. Click the **[Yes]** button to create a back up copy of your database. Otherwise, click **[No]** to continue with the table upgrade.

In addition, it is recommended that you create a backup of the "Projects" directory before you open projects in the new version of HydroGeo Analyst. This can be done using the options in "My Computer", or "Windows Explorer".

NOTE: Projects from v.1.0 and v.2.0 used "Project Manager" passwords for controlling access to the project. Once a project is upgraded to v.4.0, this password will be ignored and replaced by a username "Admin", with no password user credential; login with the Admin user name, then you must modify the Project Level Security Document (PLSD) to setup the desired access levels. These options are available under **Settings** / **Manage User Access Levels**.

NOTE: If an administrator password is lost, it cannot be retrieved. You are recommended to keep the project administrator password in a safe place, or to create multiple project administrators for multiple users, as a backup.

When you open a Map Project for the first time, you may encounter the following error: "Error in getting information for project 1. The water level table is missing or doesn't meet the HGA specification". This error occurs because water level and screen support has been added to the cross-section editor, and this table was not mapped in Templates from v.1.0. To fix this problem, follow the steps below:

- In the main window, load the **Template Manager** (Settings / Template Manager)
- Load the **Profile Settings** (click on the Set Profile Settings button from the top toolbar)
- Select the **Water Level** tab
- Select an appropriate table for the Water Level info (default is water_level)
- Select an appropriate field for the Level type (default is water_level_remark)
- **Save** and close the Template, then re-open the map project.

NOTE: Waterloo Hydrogeologic, Inc. is not responsible for any direct or indirect damages, however caused, if project data has not been securely and independently backed up. You are strongly encouraged to frequently back-up your HGA project folder and the SQL Server database.

1.5 Learning to use HydroGeo Analyst

There are several ways of getting acquainted with HydroGeo Analyst, including using the Demo Guide located on your installation CD-ROM, the Getting Started tutorial in Chapter 2, and the On-Line Help/User's Manual.

Please contact Waterloo Hydrogeologic if you require further training on HydroGeo Analyst for yourself or your company, or on other software that is developed and distributed by Waterloo Hydrogeologic.

1.5.1 HydroGeo Analyst On-Line Help

This manual is supplied to you in two forms: as a printed book, and as an On-line Help file. To view the On-Line help version of this manual, select **Help > Contents**. Some HydroGeo Analyst windows and dialogs contain

buttons, which load the appropriate help section for the current active component.

The **HydroGeo Analyst Help** window is divided into three main areas:

- A **Navigation Frame** on the left displays the **Contents**, **Index**, **Search**, and **Favorites** tabs.
- A **Toolbar** across the top displays a set of buttons to help navigate through the HydroGeo Analyst Help system.
- A **Topic Frame** on the right displays the actual Help topics included in the On-Line Help.

The tabs in the **Navigation Frame** provide the core navigational features as described below.

Contents

The **Contents** tab displays the headings in the "Table of Contents" in the form of an expandable/collapsible tree. Closed book icons represent Table of Contents headings that have sub-headings.

Index

The **Index** tab displays the list of Help topics. You can scroll to find the index entry you want, or you can type in the first few letters of the keyword in the text box, and the index will scroll automatically as you type. Double-click an index entry to display the corresponding Help topic. Alternately, you may select an index entry and then click the **Display** button to open the Help topic.

Search

The **Search** tab is used to search the On-Line Help documents for a word or phrase of interest. Simply type the search word(s) or phrase(s), then press **<Enter>** or click the **Display** button.

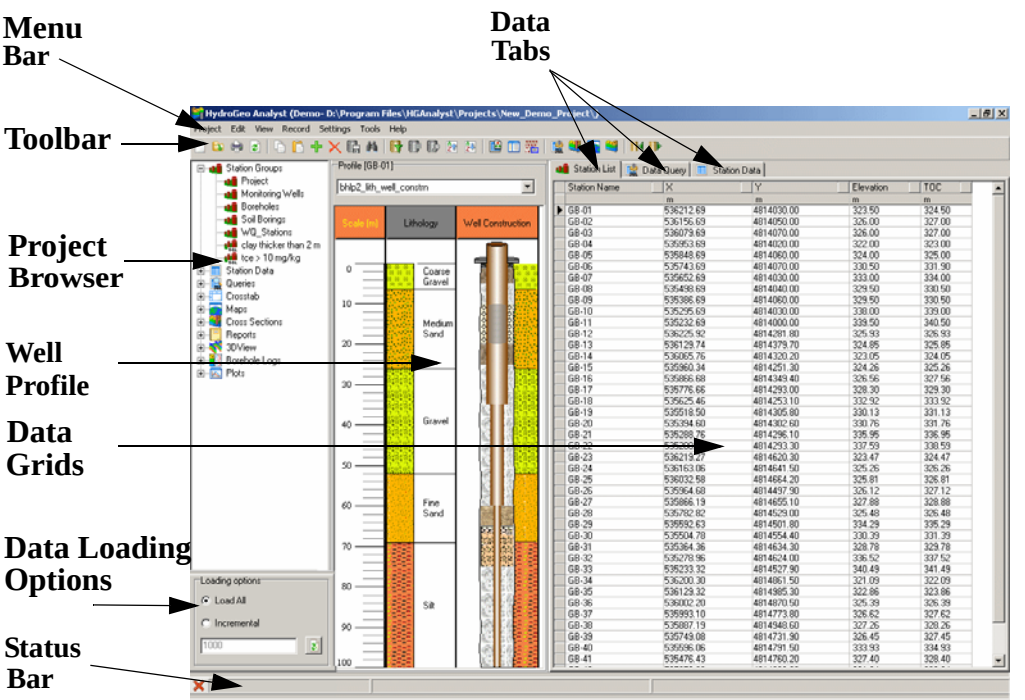
Favorites

You can add frequently accessed Help topics to a personal list of favorites, which is displayed in the **Favorites** tab. Once you have added a topic to your list of favorites,

you can access the topic by double-clicking it. Click **Add** to add the currently displayed topic to your favorites list. Select a favorite and then click **Remove** to delete a topic from your favorites list.

1.6 About the Interface

When HydroGeo Analyst is first loaded, a blank window will appear indicating no project is loaded. To create a new project, select **Project > New**; to open an existing project, select **Project > Open**. Once a project is loaded, the main window will appear; the HydroGeo Analyst demo project is displayed below, with the well profile view activated:



The HydroGeo Analyst Graphical User Interface is composed of several controls:

Data Tabs: Provides access to the various parts of the project including the Station List, Data Query, and Station Data.

Menu Bar: Contains menu commands with access to most features that are available in the HydroGeo Analyst package.

Toolbar: Contains several context sensitive short-cut buttons for the most frequently used HydroGeo Analyst features.

Project Browser: Hosts a tree view listing some of the most common components of

your project. These include nodes for Station Groups, Queries, Crosstab, Maps, Cross Sections, Reports, 3D Views, Station Data, Borehole Log Plots, and Plots

Well Profile: Provides a borehole log plot (BHLP) view for the selected station.

Data Grids: Contains the grids for data entry and visualization.

Data Loading Options: Provides settings for managing loading of data; this is especially useful when managing a large number of stations and you want to navigate through HGA without loading the entire set of stations in the station group. See “Data Loading Options” on page 20 for more details.

Status Bar: Displays the program status.

The following sections describe each of these components in greater detail.

1.6.1 Data Tabs

To facilitate data management, the main interface is separated into three tabs that are described below.

Stations List Tab

This tab hosts a grid displaying a list of stations for the selected station group. Only a few selected columns are displayed in this tab, including: **Station Name**, **X** and **Y** coordinate, **Elevation**, and **TOC** (Top of Casing) elevation. The purpose of this list is to provide an overview of multiple stations and to perform general operations based on one or more selected stations. For a more detailed view of an individual station, the **Station Data** tab should be selected.

Data Query Tab

This tab displays results from an execution of any selected data query. It can be activated by double-clicking on any query under the **Queries** node on the Project Browser, or by directly clicking on the tab itself.

In addition, through this interface, you may delete all records from a selected table.

Note: Use this feature with caution, as records will be permanently deleted from your database.

For more details on creating and editing queries, please see Chapter 7: Queries.

Station Data Tab

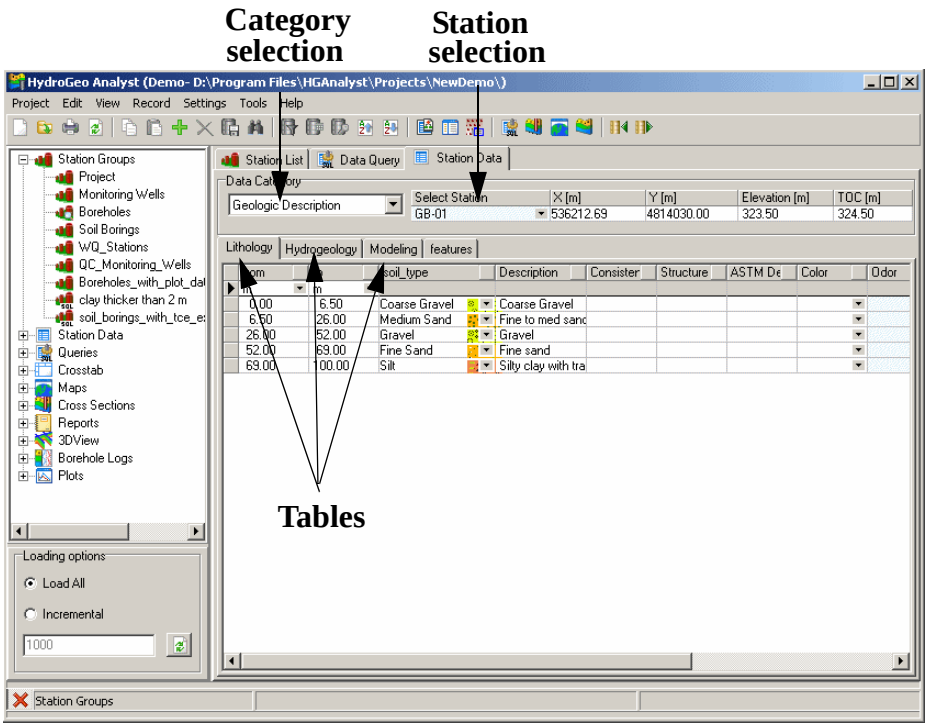
This tab allows the user to enter and view the data for a single station. This tab can be activated in two ways:

- Select a data category in the **Station Data** node in the Project Browser; this will

activate the selected data category and the related tables will be loaded for viewing and/or editing.

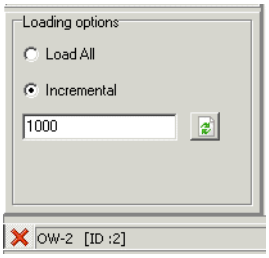
- Click directly on the **Station Data** tab, and the most recently used category will load, or the Description category will be loaded as a default.

Each table in the selected category will be displayed in a separate tab under this tab. Each of these tabs displays data from corresponding tables filtered for the Station selected at the top of the window. To change the active station, simply select a new station from the combo box above the grid.



Data Loading Options

When working with environmental data, it is common that you can be dealing with hundreds or thousands of stations. Likewise, for an individual station, there may be hundreds or thousands of records (common examples are geophysical logs, downhole data, or water levels recorded in a data logger). Reading this data from the database can be a time-consuming task. In the lower-left corner of the HGA main window (below the Project Browser) you will see the following settings:



With the Data Loading Options, it is possible to load station groups, and data in individual tables in smaller increments. The following options are available:

- If the **Load All** option is selected, then all stations will be loaded in the station group.
- If the **Incremental** option is selected, and a value is defined (default = 1000) then only the first 1000 stations in the station group will be loaded. Click on the Refresh button to load the subsequent increment of stations (load an additional 1000 stations, etc.)

Currently this feature is implemented only for the station list.

For tables other than the station list, you can use (Stop) button to stop the data loading; pressing this button will cancel the data loading, and display only those records that have were read from the database up to that point.

1.6.2 Main Menu Bar

The menu bar provides access to most of the features available in HydroGeo Analyst. see “HydroGeo Analyst Main Menu Bar” on page 107 for more details.

1.6.3 Toolbar

The toolbars that appear beneath the menu bar are dynamic, changing as you move from one window (tab) to another. Some toolbar buttons become available only when certain tabs are in view. For example, the **Add** and **Delete** toolbar buttons are only available when the focus is on a grid. Some toolbar buttons are available only in a particular context; for example, the **Paste** button is only available after the **Copy** or **Cut** command has been used.

The following tool buttons appear at the top of the HydroGeo Analyst main window. For a short description of an icon, move the mouse pointer over the icon *without* clicking either mouse button.

New button loads the Project Manager to create a new project.

Open button opens an existing HydroGeo Analyst project.

Print button sends the data item that is currently active to the Report Manager. This data item could be a list of stations, data from any table, or a query result. This feature is available only if a grid is active.

Refresh button refreshes the current view, by updating the project browser and all opened grids.

Copy button copies selected character(s) in a grid cell to the clipboard.

Paste button pastes text from the clipboard to the active cell.

Add button adds a new record; this feature is available only if a grid is active.

Delete button deletes the selected record; this feature is available only if a grid is active.

Post Data button saves (posts) all changes made to the project; this button is activated if changes to a record have been made.

Find button displays a dialog for searching in a grid with a user-specified criteria.

Filter by Value filters the grid using the value in the active cell.

Hide Selected button shows only the selected data records (rows).

Inverse Selection button will select all records that are not selected, and de-select all records that are currently selected.

Sort Ascending button sorts records in ascending order based on the selected column.

Sort Descending button sorts records in descending order based on the selected column.

Template Manager button launches the Template Manager.

List Editor button launches the List Editor.

Material Specifications button launches the Material Specifications Editor.

Query Builder button loads the utility for building simple and advanced queries.

Well Profile Viewer button loads a window displaying the profile view of the selected station. This includes data for Lithology and Well Construction (drilling procedure, filling materials, screen and well casing materials).

Map Manager button loads the Map Manager; by default, the most recently used map project will be loaded.

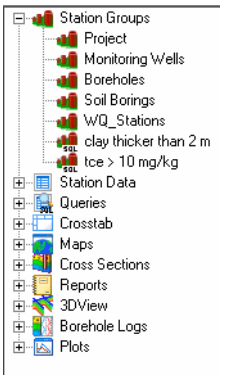
View Cross-Section button launches the Cross Section editor and displays the last edited cross section (if any).

Data Import button launches the DTS for importing data into the project.

Data Export button launches the DTS for exporting data from the project.

1.6.4 Project Browser

The project browser (tree) lists the following items:



- Station Groups
- Station Data (Data categories)
- Queries
- Crosstab
- Maps
- Cross Sections
- Reports
- 3D Views
- Borehole Logs
- Plots

These items may be part of any project. Each item is organized as a node in the tree view with one or more items under each node. If there is no item under a given node, there will be no branches available.

Station Groups

The **Station Groups** node contains the Station Groups in your HydroGeo Analyst project. By default, all projects will contain a station group named **Project** that lists all stations in the database belonging to the project. All station groups that are created for a project are listed under the **Station Groups** node below the **Project** node.

Clicking on a **Station Group** node will load the **Station List** tab, and display a limited number of columns of data for the stations belonging to that group. Additional fields and tables for each Station are available through the **Station Data** tab (discussed later in this section).

Station Data (Data Categories)

The **Station Data** node displays the visible data categories under which project tables are organized. Clicking on any of the data categories activates the **Station Data** tab (if it is not already active) and displays a tab for each of the tables classified under the selected data category. The **Station Data** tab displays information pertaining to the station currently selected in the **Station List** tab. As mentioned earlier in this manual, data categories are provided to enable logical groupings of your tables.

Queries

The **Queries** node lists all the queries that are created and available for the current project. Double-clicking on any of the queries under this node executes the query, activates the **Data Query** tab, and displays the returned results.

Crosstab

The **Crosstab** node lists all the crosstab query reports that are created and available for the current project. Double-clicking on any of the crosstab reports under this node will load the crosstab query component, where you can modify, print, or export the report.

Maps

The **Map** node lists all map projects that are available (created) for the current HydroGeo Analyst project. Double-clicking on a map project under this node loads the Map Manager (if not already loaded) and opens the selected map project into the Map Manager.

Cross-Sections

The **Cross-Sections** node lists all cross-sectional views created using the Cross-Section Editor. Double-clicking on a cross-section launches the Cross-Section Editor and loads the selected cross-section.

Reports

The Reporting component included with HydroGeo Analyst allows you to create as many reports as needed for your project, and save the layouts for future report generation. All the reports created for a selected project will be listed under the **Reports** node. Double-clicking on any of these report layouts will open a report template or a saved report. By default, the report will be displayed in print preview mode, however it is a simple task to activate the report designer in order to modify the report layout. See Chapter 11 for more details.

3D Views

The **3D Views** node contains a list of available 3D views that have been created and saved for your project. Double-clicking on a 3D view loads the selected view into the HydroGeo Analyst 3D Explorer.

Borehole Logs

The **Borehole Logs** node contains a list of all Borehole Log Plot (BHLP) templates that have been created and saved for your project. Double-clicking on a Borehole Log loads the selected template into the BHLP viewer.

Plots

The **Plots** node contains a list of all plots that have been created and saved for your project. Double-clicking on a plot will load the Plotting component.

2

Getting Started

This chapter is a tutorial which provides instructions on how to “Get Started” quickly, using your own data sets. There is information on how to create a new HydroGeo Analyst project, then enter, manipulate, and visualize the data. The user is encouraged to refer to respective chapters in this manual, for more details on each module.

The chapter is organized into the following sections:

2.1: Creating a New Project

- Database Environment
- Template Settings
- Project Settings

2.2: Data Management

- Entering Data Manually
- Importing Data Using the Data Transfer System (DTS)
- Grouping Stations

2.3: Viewing Borehole Log Plots

- Selecting a Template
- Saving and Printing

2.4: Querying the Database

- Creating a data query
- Recalling and executing queries

2.5: Mapping the Data

- Creating a Map Project
- Importing and GeoReferencing Site Maps
- Creating Contour maps
- Defining Cross Section Lines

2.6: Interpreting and Viewing Cross-Sections

- Creating Geological Cross Sections
- 3D Visualization of Cross Sections

2.7: Preparing Reports

- Creating Reports with Data from Project
- Creating Charts

Terms and Notation

The following terms and notations will be used in this exercise:

type:	Type in the given word or value
☞	Click the left mouse button where indicated
☞☞	Double-click the left mouse button where indicated
<Tab>	Press the Tab key on your keyboard
<Enter>	Press the Enter key on your keyboard

The **bold faced type** indicates menu or window items to click.

The Main Menu items are the items available at the top of the HydroGeo Analyst Parent window.

2.1 Creating a New Project

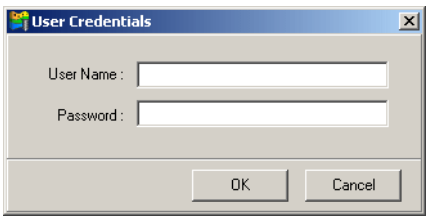
To start HydroGeo Analyst,

☞ **Start** and choose **Programs > WHS> HydroGeo Analyst>HydroGeo Analyst 4.0**, or double-click on the desktop icon .

When HydroGeo Analyst is loaded, there will be no project loaded by default. In order to enter your station data, you either have to open an existing project or create a new one using the **Project Wizard**. To create a new project, follow through the steps of the Project Wizard as outlined below:

☞ **Project > New** from the main menu, or click the (New) button from the toolbar.

A prompt will appear for the User name and password, in a dialog as shown in the example below:



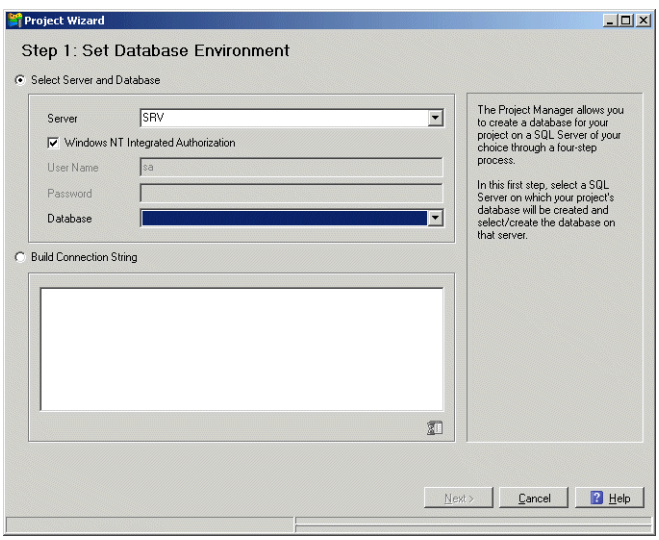
HGA includes a default user “Admin” with no password.

You must enter a valid user name and password, for a user that has privileges for creating new projects. HGA will then check these credentials in the security document, to confirm that this user has these privileges. For more details on assigning user access controls, please see Chapter 4: Application Level Objects.

If you have modified the default Admin user, or added additional users (with permissions to create projects), then login now with the appropriate credentials.

☞ Click **[OK]**

The **Project Wizard** window will load as shown below:


Project Wizard
Step 1: Set Database Environment
Select Server and Database
Server
SRV
Windows NT Integrated Authorization
User Name
sa
Password
Database
Build Connection String
The Project Manager allows you to create a database for your project on a SQL Server of your choice through a four-step process.
In this first step, select a SQL Server on which your project's database will be created and select/create the database on that server.
Next >
Cancel
Help

The Project Wizard contains three steps, each step appearing in a new window, with the various settings for a new project. These include:

- **Step 1: Set Database Environment**: In this window, specify the server and database to be used for the HG Analyst project, and the connection string if necessary.
- **Step 2: Create Project Dependent Tables**: Select a database structure from a list of available templates, or create a new database template.

- **Step 3: Set Project Properties, Location, and Soil Settings**: In this window, specify the project name, project folder, project location, projection system, units, and specify the SCS (soil) settings for the project.

The project wizard works in a sequential fashion; after defining the necessary inputs in each window, press the **[Next>]** button to proceed. The **[Next>]** button will only become active after the necessary fields have been defined. Required fields are indicated by an asterisk (*).

The first window that appears is **Step 1: Set Database Environment**.

2.1.1 Step 1: Set Database Environment

In the first step, define the server and database settings for the new project. HydroGeo Analyst uses Microsoft SQL Server 2005 Express to host the project database. Any MS SQL Express server that is currently installed on any computer on your network could be used as long as you have the appropriate access rights to it. If you are working on a stand-alone computer, then the "server" would be the local computer using SQL Express. Once the server is selected, select from an existing database on this server, or create a new database.

In this example, you will create the project on the local machine. For details on building a connection string to a MS SQL Server on a network, please refer to Chapter 4: "Step 1: Set Database Environment" on page 168.

Select Server and Database

- ☞ Choose the **Select Server and Database** option.
- ☞ Beside **Server** select your local machine as the Server; this will appear as Computer_Name\WHI in the combo box.

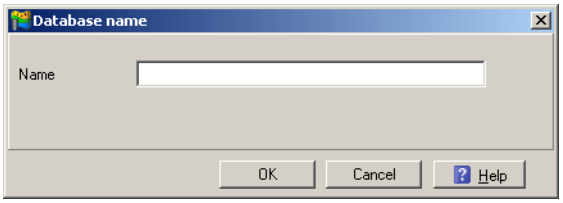
If a separate login password is not required for the selected Server computer, be sure to check the box beside **Windows NT Integrated Authorization**. Otherwise, de-select this option, and specify a User Name and Password. This will allow HydroGeo Analyst to automatically log on to the Server each time the project is opened

Note: If you cannot see your local WHI instance of SQL Express when creating a new project, or opening an existing project, please refer to 15.7: Appendix G: Frequently Asked Questions (FAQ's) for some troubleshooting suggestions.

After the Server is selected, HydroGeo Analyst will automatically scan the Server for valid SQL databases. These databases will then appear in the combo box beside **Database**. You have the options of using an existing HydroGeo Analyst database to host your project, or creating a new database on the specified server.

In this example, a NEW database will be created on the local machine:

☞ Beside **Database,** select **Create New Database** from the combo box. The following dialog will appear:



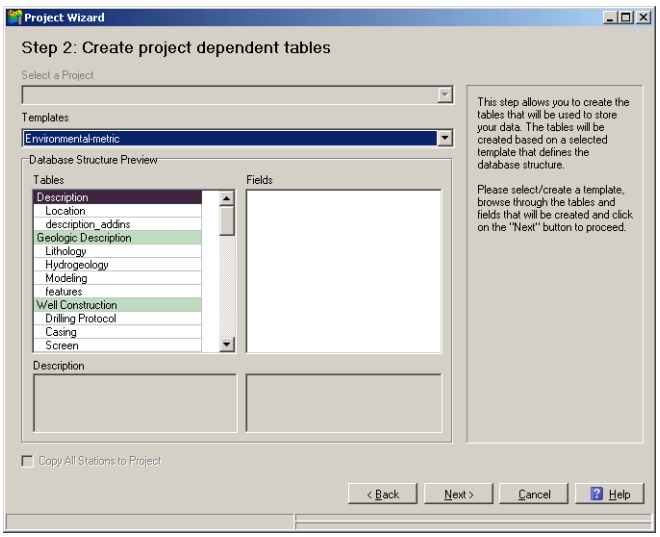
type: SampleDatabase

☞ Click **[OK]**.

☞ **[Next>]** to create the new database, and proceed to the Step 2 in the Project Wizard.

2.1.2 Step 2: Create Project Dependent Tables

The second step in the Project wizard contains the **Database Structure** settings, which includes the database template for the new project. These options are shown in the figure below:



In this window, select from one of the pre-defined Database templates for the new project. The template contains the necessary tables, fields, relationships, linked lists, and reports for storing and interpreting data in the HydroGeo Analyst database. The following templates are available, in both imperial and metric length units:

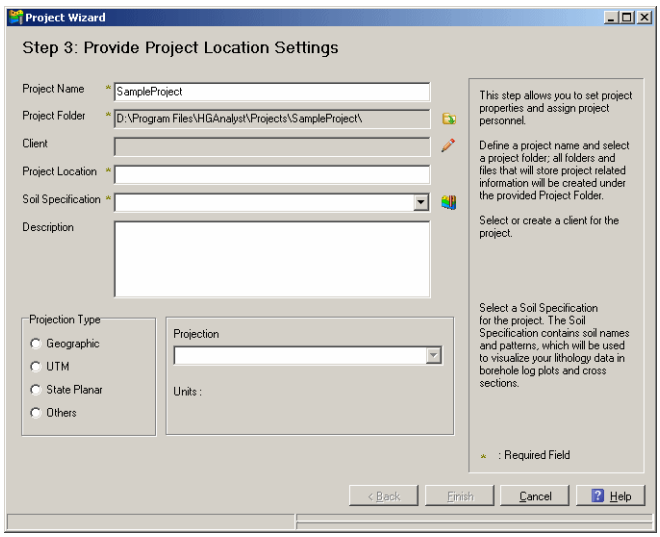
- Environmental
- US EPA Region 2
- US EPA Region 5
- MOE - WWIS (Ontario Ministry of Environment Water Well Information System)

☞ **[Environmental-metric]** template, from the **Templates** combo box, for this example.

☞ **[Next]** button to create the project dependent tables for this database.

2.1.3 Step 3: Set Project Properties and Location

The third step in the Project wizard contains general project information, as seen in the figure below:


Project Wizard
Step 3: Provide Project Location Settings
Project Name
SampleProject
Project Folder
D:\Program Files\HGAnalyst\Projects\SampleProject\
Client
Project Location
Soil Specification
Description
This step allows you to set project properties and assign project personnel.
Define a project name and select a project folder; all folders and files that will store project related information will be created under the provided Project Folder.
Select or create a client for the project.
Projection Type
Geographic
UTM
State Planar
Others
Projection
Units :
Select a Soil Specification for the project. The Soil Specification contains soil names and patterns, which will be used to visualize your lithology data in borehole log plots and cross sections.
: Required Field
< Back
Finish
Cancel
Help

In this window, specify a project name, folder, and client(s).

In the first line,

type: SampleProject for the **Project Name**

In the next line, the **Project Folder** is defined. By default, the project name will be used for the folder name, and the project will be created in the HGAnalyst/Projects folder (as shown above). If desired, the project directory can be changed now, by clicking the folder button .

The next line is used to define the **Client** information; this field is optional, and is not required for this exercise.

Enter the **Project Location**

type: Waterloo, Ontario

Next, specify the **Soil Specification** for the project. The available soil settings include:

- USCS (Unified Soil Classification System)
- USDA (United States Department of Agriculture)
- DIN 4023 (Deutsches Institut für Normung e.V.)
- IAH (International Association of Hydrogeologists)
- Compton

If these settings are not adequate, a new Soil Specification can be easily created. For more details on customizing the soil settings, please refer to section 3.5: Material Specifications Editor in Chapter 3.

☞ **DIN 4023** for this example.

There is an option to enter a **Description** of the project location at the bottom of this window (not a required field).

Next, define the **Project Location Settings** information, such as the projection system and coordinate settings. Under the **Projection Type** frame, specify the coordinate system used for this project. You may choose from the following list:

- Geographic
- UTM
- State Planar
- Other

For this sample project,

☞ **UTM**

Once the projection **Type** is selected, choose the **Projection** from the combo box on the right side of the window. The **Units** will be selected automatically, based on the selected projection type (e.g. UTM will use m, State Planer will use feet, etc.)

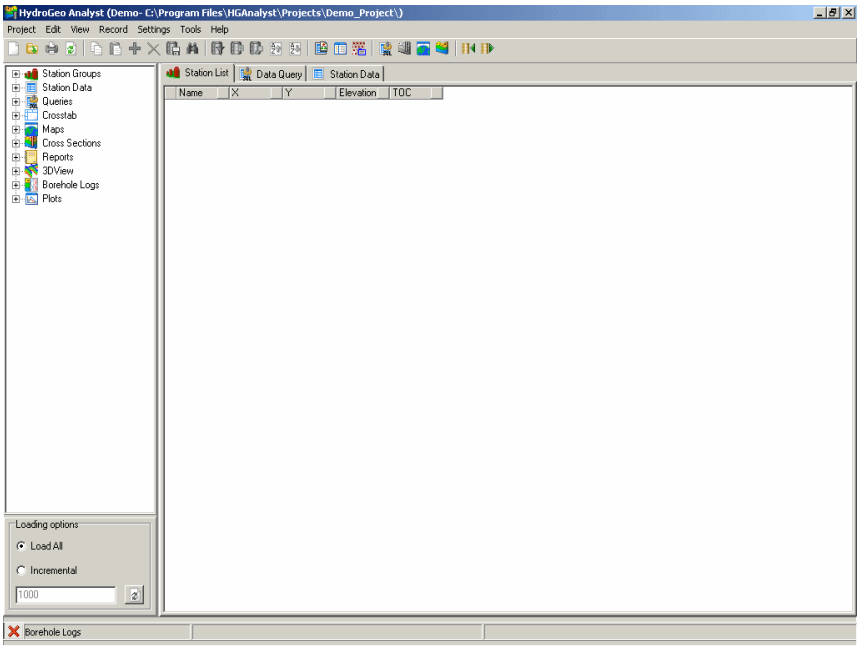
☞ **NAD 1983 UTM Zone 17N**

☞ **[Finish]** to complete the Project Wizard.

The first time the project loads, the settings for User Access Management will be presented. As the creator of the new project, you will have Administrator rights, where you can add/remove users, and assign access rights. For more details on this feature, please see Chapter 4: User Access Management.

☞ **[X]** button in the upper-right corner, to close the User Access Management window.

The new project will then be created, with the necessary tables, fields, and settings. Once this is complete, the main HydroGeo Analyst window will appear with the new project, as shown below.



If necessary, the project settings can be modified at any time by selecting **Properties** from the **Project** menu.

In addition, the database view and structure can be modified using the Template Manager. For more details, see Chapter 5: Template Manager.

Now that the new project has been created, the station data may be entered. For instructions on this procedure, please continue to the next section.

2.2 Data Management

There are two options for entering data into the new project:

- Manually in the grids; OR
- Importing from other sources using the Data Transfer System (DTS)

To facilitate data entry, there are two tabs available in the HydroGeo Analyst window, located directly below the main toolbar: **Station List** and **Station Data** tab.

- **Station List Tab**: This tab hosts a grid displaying a list of stations for the selected station group. Here, you can enter the basic location information for the stations: Name, X and Y coordinate, Elevation, and TOC (Top of Casing) elevation.

- **Station Data Tab**: This tab allows entering and viewing data for an individual station. This tab can be activated either by clicking on a data category node in

the **Project Browser** or by clicking on the tab itself, provided at least one station is already selected. Each table in the selected **Data Category** will be displayed in a separate tab under the **Station Data** tab. The data is displayed for the Station selected at the top of the window. To change the active station, simply select a new station from the list above the grid.

Now that you are familiar with the data entry options, a few brief examples are provided below.

2.2.1 Entering Data Manually

If there are only a few stations to be entered into the project (or if you have data as a hard copy), then the quickest method may be to manually enter the data for each station. (If you have a large data set in a source file(s), feel free to skip ahead to the section Importing Data using the DTS).

Example: Creating a New Station

- **+** beside the **Station Groups** node in the project browser
- **Project** under the **Station Groups** node in the project browser
- **Record > Add** from the main menu, or press the (Add) button in the toolbar. A new row will be added to the grid in the **Station List** tab. Enter the following information for this station:

In the **Name** column,

type: BH1

- <**Tab>** or <**Enter>** key on the keyboard, to shift the focus to the next cell.

In the **X** column,

type: 537381.50

In the **Y** column,

type: 4812036.33

In the **Elevation** column,

type: 347

In the **TOC** column,

type: 348

To post (save) the data for this record,

- **Record > Post** from the main menu, or press the (Post) button in the toolbar.

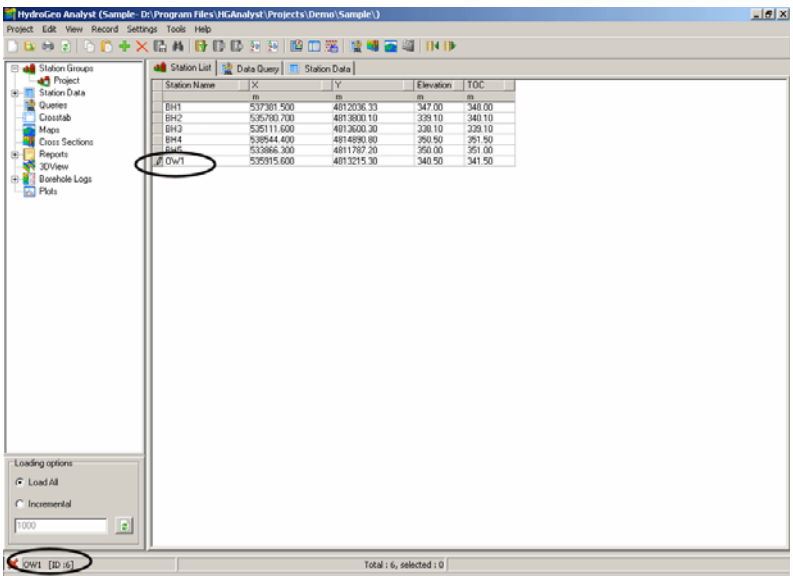
Using the same procedure, enter the following information for these new stations:

Name	X	Y	Elev	TOC
BH2	535780.7	4813800.1	339.1	340.1
BH3	535111.6	4813600.3	338.1	339.1
BH4	538544.4	4814890.8	350.5	351.5
BH5	533866.3	4811787.2	350.0	351.0
OW1	535915.6	4813215.3	340.5	341.5

As long as you remain in the same window, you do not need to press the **Post** button after every entry. Do so to finalize the changes you have made before moving to the next window.

Note the color of the fields you have modified is different (yellow); once you press the **Post** button they return to the default state (white). This feature allows you to easily distinguish between permanent changes, and the recent ones that have not yet been saved to the database.

Once you are finished, remember to save the new data. The stations should now appear in the **Station List**, similar to the image shown below:



As each station is added to the database, it is assigned a unique station ID value. The station ID for the selected station can be seen in the task bar in the Station List window (an example is circled above for station OW-1, the station ID is 6). The station ID is the primary key; it is required in all source tables during import, so that data can be

matched to the appropriate station. If your source tables do not contain station ID's, you may use the station names, and HGA will map the data to the appropriate station ID.

Next, you will enter additional data for one of the new stations.

- ☞ **BH1** from the Station List, then
- ☞ **Station Data** tab.

The **Station Data** tab provides the interface for viewing/entering detailed data for an individual station. There are several Data Categories available in HydroGeo Analyst; Data Categories are provided to enable logical grouping of your tables. A **Data Category** may be selected from the combo box at the top of the window, or from the **Station Data** node in the project browser. By default, the **Description** data category will be displayed, and the **Location** table will be activated for this station.

Selecting a new Data Category will display all the available tables and fields belonging to the selected category. The following is a summary of the Data Categories included in HydroGeo Analyst, along with some of the tables and fields:

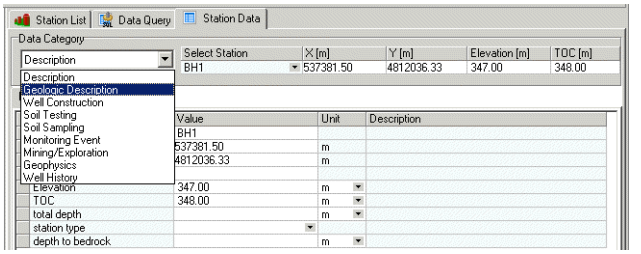
Data Category	Tables and Fields
Description	Station name, world coordinates, elevation, TOC elevation
Geologic Description	Soil description (e.g. from split-spoon soil sampling and drilling)
Well Construction	Well casing intervals, packing depths, drilling method, etc.
Soil Testing	Soil physical properties
Soil Sampling	Soil sampling events (chemical analysis)
Monitoring Event	Water table elevations or groundwater chemistry data
Mining and Exploration	Alteration, Mineralization, Structure, Samples, Down Hole Survey, Down Hole Geophysics
Geophysics	Conditions, Gamma, Neutron, 64 in E-log, 16 in E-log, Density
Well History	Well installation, owner, permit to take water, decommissioning, etc.
User Category	User-defined category, which may contain any other data types not covered by the previous categories (eg. Surface Water, Air Quality, etc.).

The example below illustrates how to enter Lithology data in the Geologic Description category, for several stations.

Example: Entering Lithology Data

Ensure that the **Station Data** tab is still selected, and **BH1** is the selected station.

- ☞ **Geologic Description** from the **Data Category** combo box



Under the **Lithology** tab, enter the following soil description information.

HINT: Use the **<Tab>** or **<Enter>** key on the keyboard, after each value, to shift to the next column in the grid.

from (m)	to (m)	Soil_type	Description
0	5	Coarse Gravel	coarse gravel
5	10	Medium Sand	loamy sand
10	30	Gravel	sandy gravel

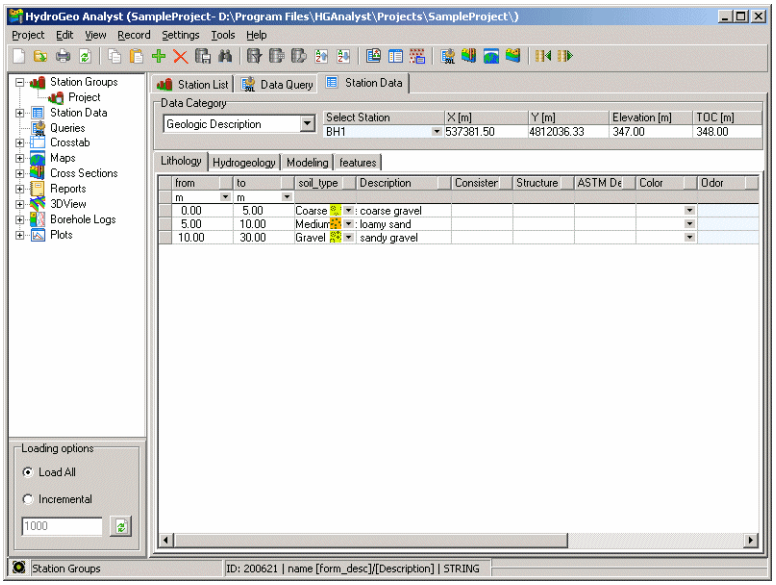
HINT: After each row, press the (Add) button to add a new record to the grid.

The Soil types may be selected from the a pre-defined soil classification list (you will recall that the DIN 4023 Soil Classification System was selected when the project was created). Simply choose an appropriate soil type from the list.

NOTE: All depth-dependent data must be entered as “depth-to” (0-5, 5-10, 10-15, etc.), and in ascending order.

Once the data has been entered,

- ☞ **Record > Post** from the main menu or press the (Post) button in the toolbar, to save the data. The grid should be similar to the one shown below



Using the steps above, enter lithology data for the remaining boreholes.

HINT: First select the new station (BH2) from the **Select Station** combo box above the grid, or return to the **Station List**, and select BH2 from the list, then return to the **Station Data** tab.

BH2

from (m)	to (m)	Soil_type	Description
0	6.5	Coarse Gravel	coarse gravel
6.5	16	Medium Sand	loamy sand
16	22	Gravel	sandy gravel

HINT: Remember to save (post) the data, before proceeding to the next station. You will be prompted to save your data when switching between stations if the data has not already been posted.

BH3

from (m)	to (m)	Soil_type	Description
0	4	Coarse Gravel	till-gravel
4	17	Medium Sand	loamy sand
17	30	Gravel	sandy gravel

BH4

from (m)	to (m)	Soil_type	Description
0	5	Coarse Gravel	till-overburden
5	20	Medium Sand	loamy sand
20	31.2	Gravel	sandy gravel

BH5

from (m)	to (m)	Soil_type	Description
0	8	Coarse Gravel	till-overburden
8	22	Medium Sand	loamy sand
22	30.8	Gravel	sandy gravel

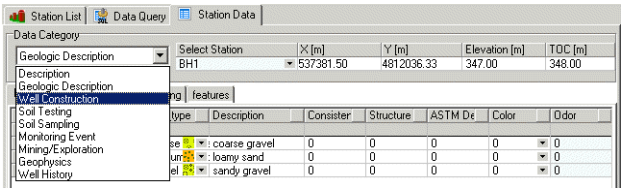
HINT: Remember to save (post) the data, before proceeding to the next station.

In the next section, you will learn how to enter Well Construction data for one of the stations.

Example: Entering Well Construction Data

In this section, you will enter well construction data for one of the boreholes. This data will be used for creating and visualizing a Borehole Log Plot (BHLP).

- ☞ **Station List** tab
- ☞ **BH1** from the list
- ☞ **Station Data** tab
- ☞ **Well Construction** from the **Data Category** combo box



Enter the following well construction information:

☞ **Drilling Protocol** tab (table) from the grid

type: from: 0

to: 30

diameter: 1.0

method: Hollow Stem Auger.

Next, enter the **Casing** information.

☞ **Casing** table from the grid

You will be prompted to save the changes.

☞ **[Yes]**

For this well, define the following info:

Casing interval from 0 to 30 m, **Steel** material, 0.5 **m** diameter.

Next, enter the **Screen** information.

☞ **Screen** table from the grid

You will be prompted to save the changes.

☞ **[Yes]**

For this well, define the following info:

Screen ID = 1, Screen from 15 to 30 m, 0.3 **m** diameter, **Plastic** material, Slot Number: 20,.

Next, enter the **Annular Fill** information.

☞ **Annular Fill** table from the grid

You will be prompted to save the changes.

☞ **[Yes]**

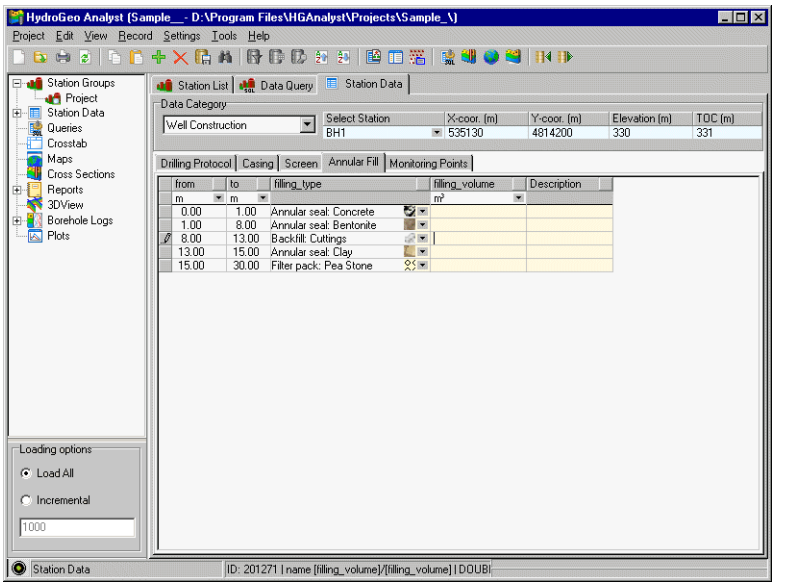
For this well, define the following info:

from (m)	to (m)	filling_type
0	1	Annular Seal: Concrete
1	8	Annular Seal: Bentonite
8	13	Backfill cuttings
13	15	Annular Seal: Clay
15	30	Filter pack: Peastone

Once the data has been entered,

☞ **Record > Post** from the main menu or press the (Post) button in the toolbar, to save the data.

The grid should appear similar to the one shown below:



Example: Entering Monitoring Event Data

In this section, you will define water level data for OW1, the monitoring well that was defined previously in the **Station List**. To do so,

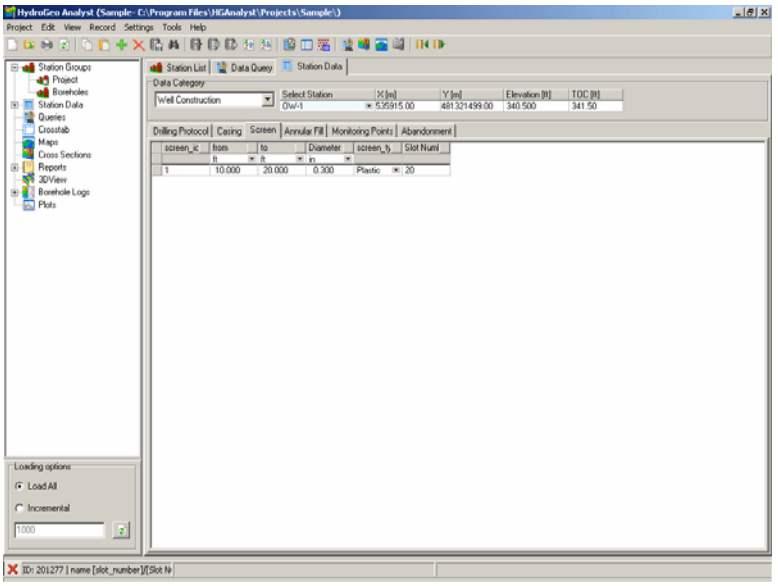
- **OW1** from the combo box at the top of the window, under **Select Station**

First the screen details must be defined in the well construction category,

- **Well Construction** from the **Data Category** combo box
- **Screen** tab (table) from the grid

Define the following details:

Screen ID = 1, from 10 to 20 m, diameter = 0.3 m, type = plastic, slot no. 20



Now, you can define the water level.

- **Monitoring Event** from the **Data Category** combo box
- **[Yes]** to save the changes for this record.
- **Water Level** tab (table) from the grid

Enter the following information in this grid:

For the ScreenID

- **1** from the combo box

In the Date column,

type: 5/5/2004

In the Time column,

type: 1:00:00 PM

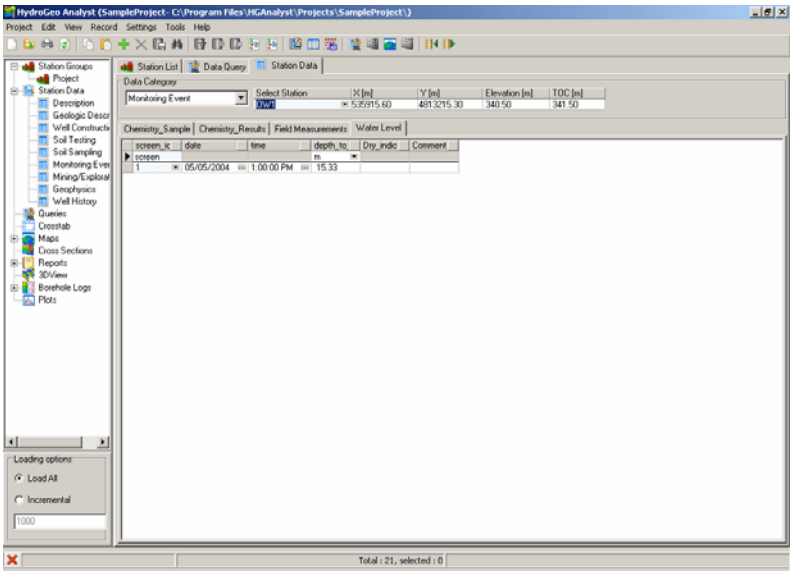
In the Depth to Water Level (m) column,

type: 15.33

Once the data has been entered,

☞ **Record > Post** from the main menu or press the (Post) button in the toolbar, to save the data.

The remaining fields can be left blank. Your table should be similar to that shown in the figure below:



As demonstrated here, it can be quite time-consuming to enter data manually. If the source data is available in a text file, spreadsheet, or database, it is much more efficient to import the data into the new HydroGeo Analyst project. This option is explained in the next section.

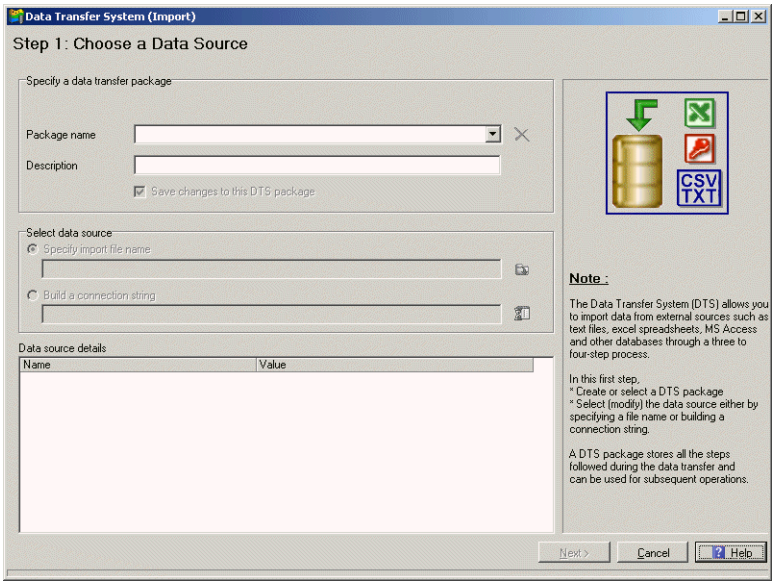
2.2.2 Importing Data using the Data Transfer System (DTS)

HydroGeo Analyst allows data to be imported from a variety of sources, using the Data Transfer System (DTS). A few examples are provided below.

Example: Importing Stations from an Excel File

The following example demonstrates how to import data using the DTS. You will import some additional borehole stations to the Sample project. (The DTS will be briefly covered in this section; for more details on this feature, please see Chapter 6: Importing Data using the DTS).

☞ **Project > Import > Data** from the main menu. This will load the **Data Transfer System** as shown below:


Data Transfer System (Import)
Step 1: Choose a Data Source
Specify a data transfer package
Package name
Description
Save changes to this DTS package
Select data source
Specify import file name
Build a connection string
Data source details
Name
Value
CSV
TXT
Note :
The Data Transfer System (DTS) allows you to import data from external sources such as text files, excel spreadsheets, MS Access and other databases through a three to four-step process.
In this first step,
* Create or select a DTS package
* Select (modify) the data source either by specifying a file name or building a connection string.
A DTS package stores all the steps followed during the data transfer and can be used for subsequent operations.
Next >
Cancel
Help

In the **Choose a Data Source** window, create a data package and select the source file**:**

- ☞ **Package Name**, and select **New Package** from the combo box

  type: Stations in the box that appears

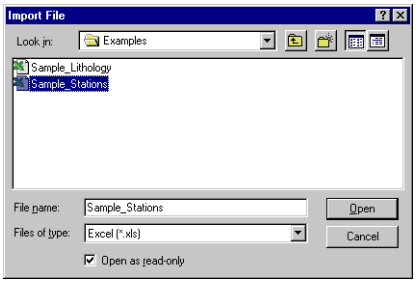
- ☞ **[OK]**

(The data package will save the DTS import settings and configuration, for quick and easy recall later on).

- ☞ button, beside the **Specify Import File name** field

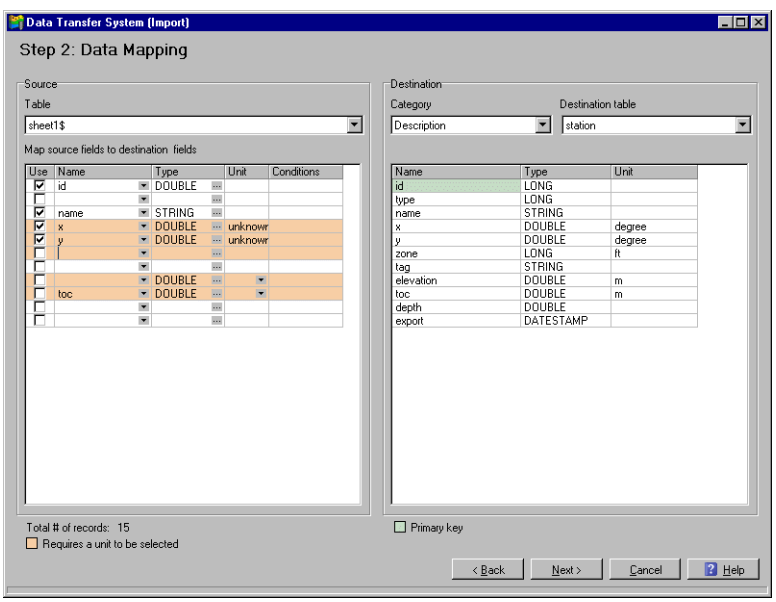
In the Import File dialog,

- ☞ Change the **Files of type => Excel (.xls)**
- ☞ **Sample_Stations.XLS** file, located in the "...\Examples" folder (located in the HG Analyst program folder). The default folder is "D:\Program Files\HGAnalyst\Examples".



- ☞ **[Open]**
- ☞ **[Next]** to proceed to Step 2 of DTS

Once the data source is provided, the next step is to match a **Source** table with a **Destination** table. The DTS provides an interface that can be used to select the destination HydroGeo Analyst table by first selecting the data category that contains the table and the desired destination table. Once the destination table is selected, all fields in the table will be listed for field mapping.



The source table containing the data to be imported can be selected from the list of tables on the left side of this window.

Under **Source Table**,

- ☞ Sheet1$ (if it is not already selected) from the combo box

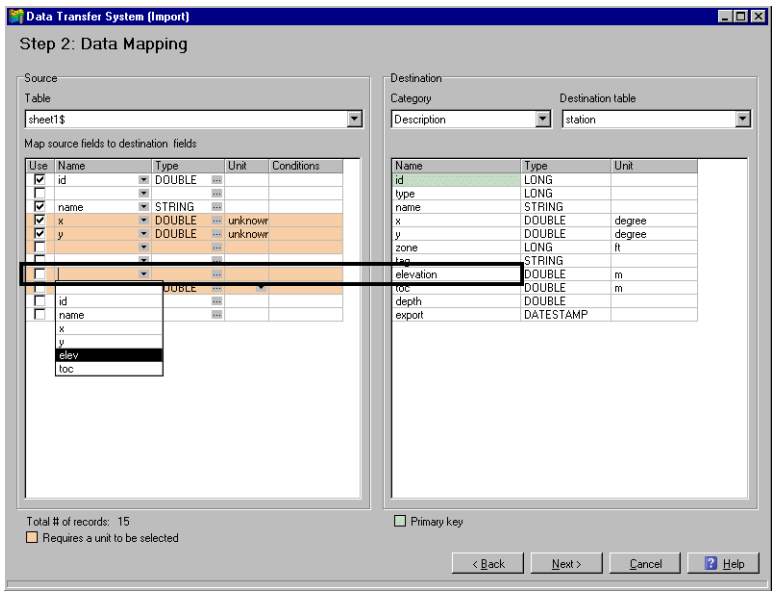
The DTS makes an effort to automatically match fields from the source table with those in the selected destination table. If the field names are exactly the same, the fields will be mapped automatically. Unmapped fields will appear blank; this indicates that the DTS was unable to match the source field to a field in the HydroGeo Analyst database. Therefore, a field must be manually selected from the available list, and mapped to the appropriate source field.

In this example, some of the fields have been detected and mapped automatically: ID, Name, X, Y, and TOC; but the Elevation field needs to be mapped manually.

NOTE: As a minimum, each source table must contain either the Station ID or Station name for each record. These fields are required to match the source data to the appropriate stations in the database.

Under the **Source** table,

☞ Click on the blank field directly above **TOC**; this field corresponds to the Destination field **Elevation.** A list of available fields will appear, as seen below.



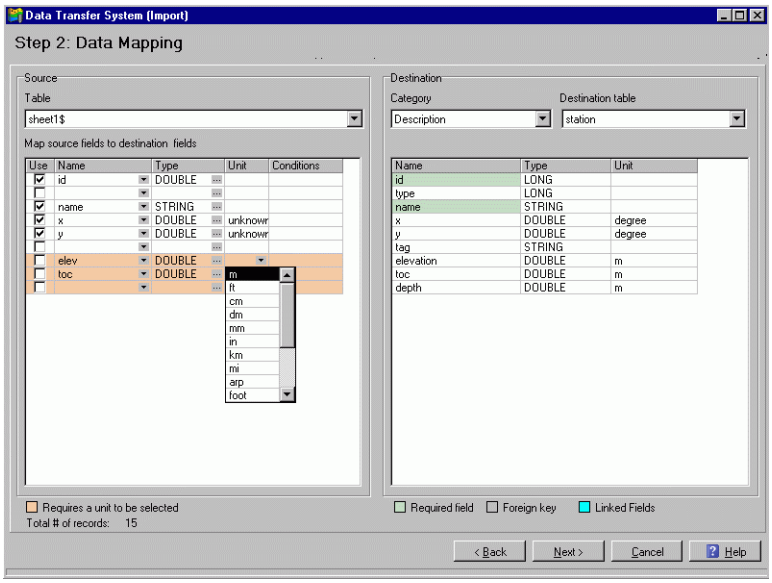
☞ **Elev** from this list; this field contains the Elevations for the stations.

NOTE: The remaining unmapped fields are not necessary for this project.

Next, define units for a few of the “length” type fields highlighted in the **Source** table (Elev and TOC). To do so, locate the **Unit** column under the **Source** table, and select a unit for the Elev field

☞ **m** from this list.

Repeat this for the TOC field, as shown below.



Next, select these fields for importing. Under the **Use** column,

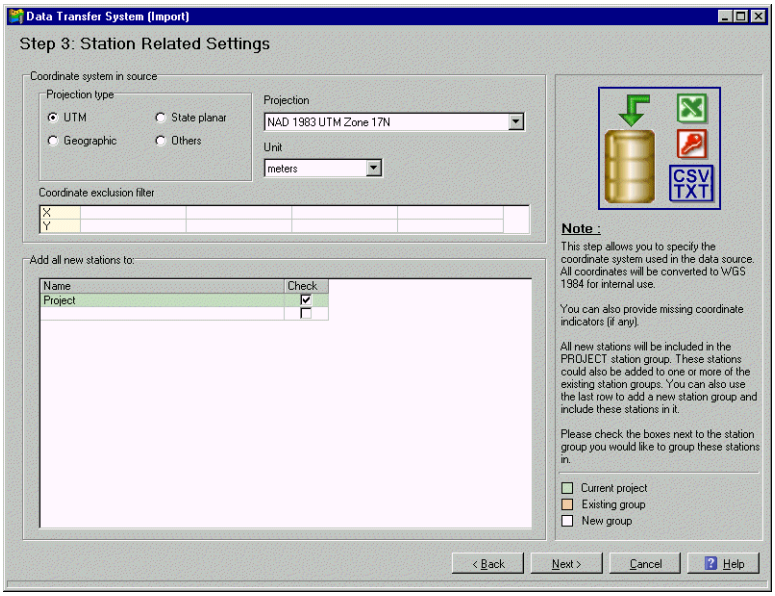
☞ **Use** for Elev, and

☞ **Use** for TOC (and a check mark will appear beside this field)

NOTE: The units for station X,Y co-ordinates will be defined in Step 3 of the import routine.

☞ **[Next]** to proceed to Step 3 of the DTS.

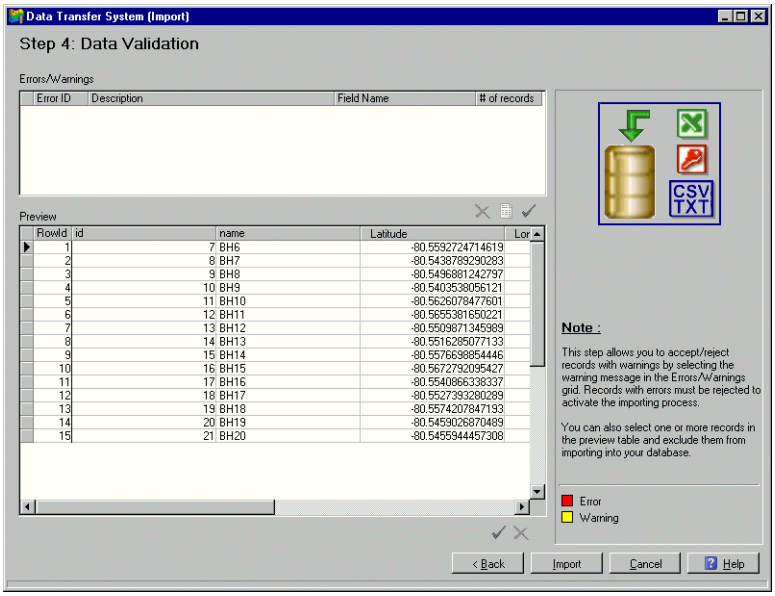
The next window is the **Station Related Settings**. In here, select the Projection Type and Units for the station coordinates in the source file.


Data Transfer System (Import)
Step 3: Station Related Settings
Coordinate system in source
Projection type
UTM
State planar
Geographic
Others
Projection
NAD 1983 UTM Zone 17N
Unit
meters
Coordinate exclusion filter
X
Y
Add all new stations to:
Name
Check
Project
CSV
TXT
Note :
This step allows you to specify the coordinate system used in the data source. All coordinates will be converted to WGS 1984 for internal use.
You can also provide missing coordinate indicators (if any).
All new stations will be included in the PROJECT station group. These stations could also be added to one or more of the existing station groups. You can also use the last row to add a new station group and include these stations in it.
Please check the boxes next to the station group you would like to group these stations in.
Current project
Existing group
New group
< Back
Next >
Cancel
Help

For this example, there is no need to change the projection, since the station coordinates in the source are in the same projection system as the one defined for the project. This step also allow you to specify the destination station group.

☞ **[Next]** to proceed to the last step of the DTS.

The last step of the DTS is the **Data Validation** window, and this provides a preview of the data to be imported. Errors or warnings, if any, will be listed along with the data.



The data is checked against three conditions, namely:

- Proper Station Locations (in Lat - Long format);
- Specified conditions for each field (if any); and
- Data type compatibility.

The DTS converts station co-ordinates into latitude-longitude format, and displays the converted values in the **Preview** frame. Stations are converted and stored in the database in this format; however the station co-ordinates may be displayed in HydroGeo Analyst in any projection system desired (for this project, stations will be displayed in NAD 1983 UTM Zone 17 N).

By default all data marked as erroneous will not be imported. However, all warnings are ignored by default. One or more of these error messages can be selected and the data affected by those errors can either be rejected or accepted. Erroneous records will not be accepted for importing unless the errors are fixed. All values causing errors are highlighted in different colors. Red represents rejected or erroneous records; yellow represents a warning/caution for the selected records.

Each of these problematic records can be selected and edited before it can be accepted for importing. Once a record is edited, it can be accepted using the **[Accept]** feature for records.

For this example, there should be no errors/warnings present.

☞ **[Import]** to import the data.

Read the confirmation message.

- **[OK]**
- **[Close]** to close the DTS

Example: Importing Lithology Data

In this section, you will import Lithology data from a file. This data will be later visualized in 2D cross sections, and with the 3D Explorer.

- **Project > Import > Data** from the main menu.
- **Package Name**, and select **New Package** from the combo box

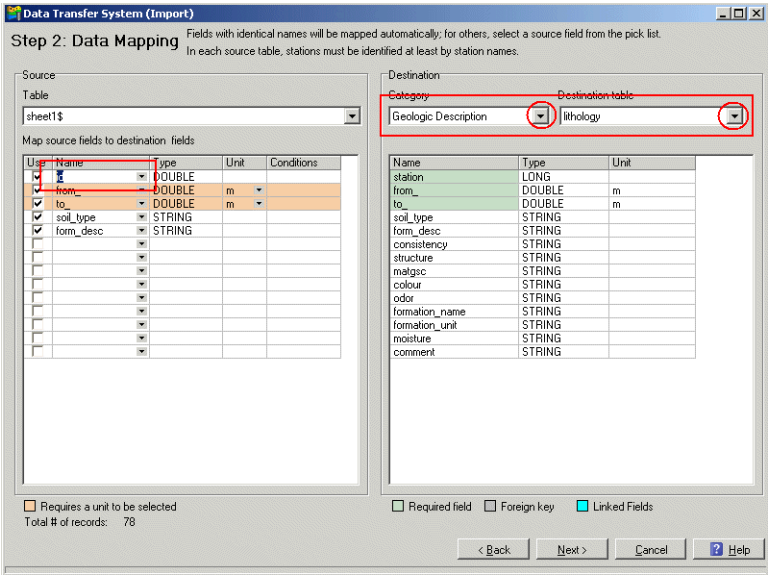
type: LithologyData in the box that appears

- **[OK]**
- button, beside the **Specify Import File name** field

In the Import File dialog,

- Change the **Files of type => Excel (.xls)**
- **Sample_Lithology.XLS** file, located in the "...\Examples" folder (under the installation folder). The default installation folder is "D:\Program Files\HGAnalyst\Examples".
- **[Open]**
- **[Next]** to proceed to the next window in the DTS

In the **Data Mapping** window, you must select a new **Destination Data Category** and **Table** (from the right side of the window). In this case, the Lithology data will be imported to the Geologic Description category, Lithology table. Select the appropriate items from the combo boxes, as shown in the image below



Under **Destination**,

- **Geologic Description** for the new **Destination Data Category**
- **Lithology** for the new **Destination table**

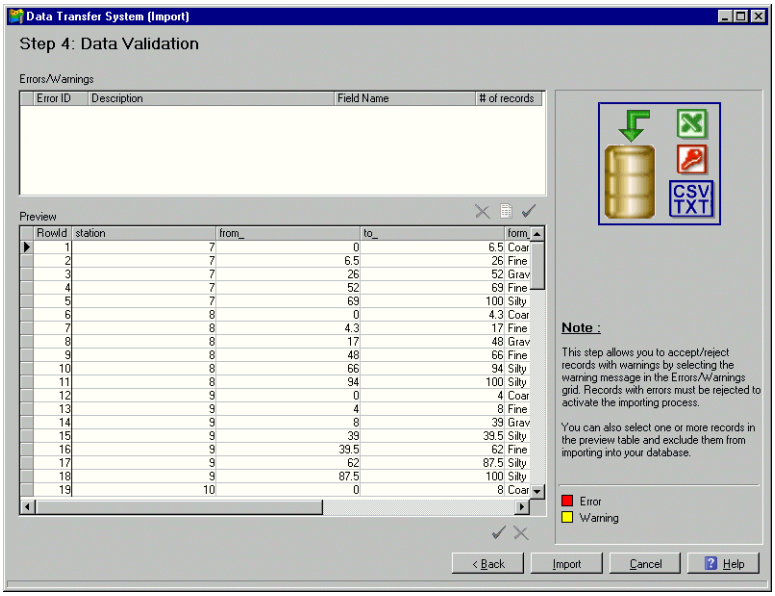
Under **Source Table**,

- **Sheet1$** (if it is not already selected) from the combo box

Next, map the fields and select appropriate units. In this example, most fields are automatically mapped, since the field names in the source are identical to the field names in the destination. However, the **ID** field must be manually mapped, and the units must still be selected for the length field types.

- **m** for the units for the **From_** and **To_** fields
- **Use** for both these fields
- **[Next]** to continue

The next window is Data Validation. If you mapped the fields correctly, then your DTS window should appear similar to the one shown below:



NOTE: Step 3 is not needed for this data import, since there are no station related settings.

For this example, there should be no errors/warnings present.

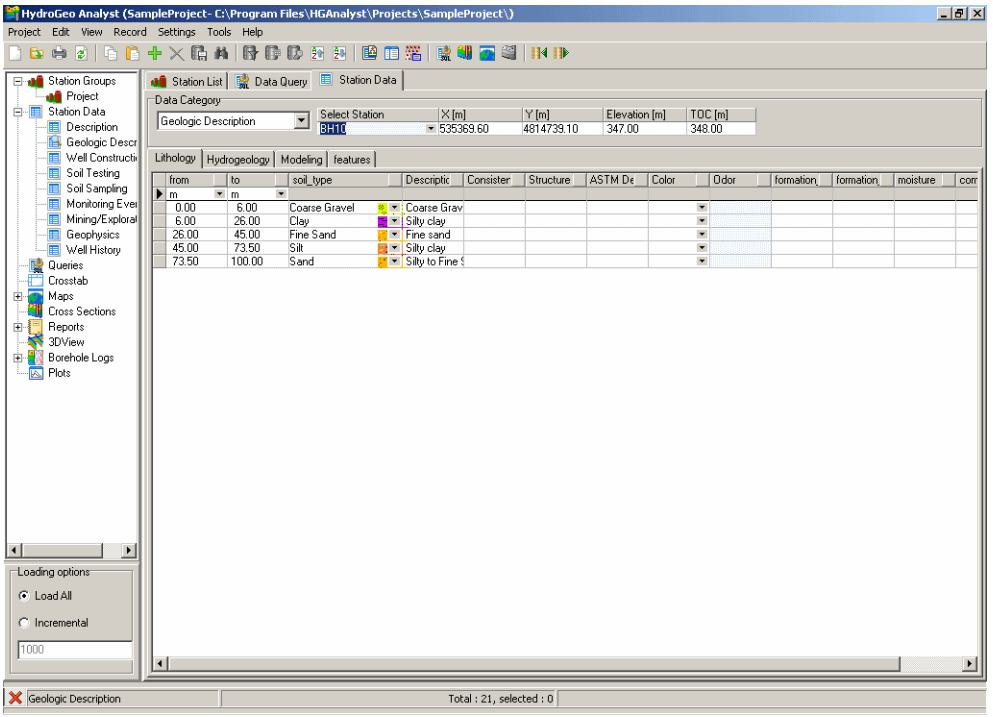
☞ **[Import]** to import the data.

A confirmation message appears stating that the records will be inserted to the database.

☞ **[OK]**

☞ **[Close]** to close the DTS

The new lithology data should now appear in the project. To confirm, select one of the new Boreholes from the **Station List**, load the **Station Data**, and view the **Geologic Description**, **Lithology** table. An example, for BH10 is shown below



Since the data was imported directly to the SQL Server database, it is not necessary to Post (Save) the changes.

In the next section, you will import soil chemistry data for the boreholes.

Example: Importing Soil Chemistry Data

In this section, you will import soil chemistry data from a file.

In most of the data models provided with HGA, chemistry samples must have a sample code (the field name is sys_sample_code in many database schemas). When importing the chemistry data, you need to import the sys_sample_code first, in the Parent Tree of the database (Soil_Sample table), THEN import the chemistry data chemistry data into the Soil_Chemistry table (child table)

A unique sys_sample_code should be assigned for each sample; the same sample code may be used for multiple parameter analysis.

Import Sample Codes

- ☞ **Project > Import > Data** from the main menu.
- ☞ **Package Name**, and select **New Package** from the combo box

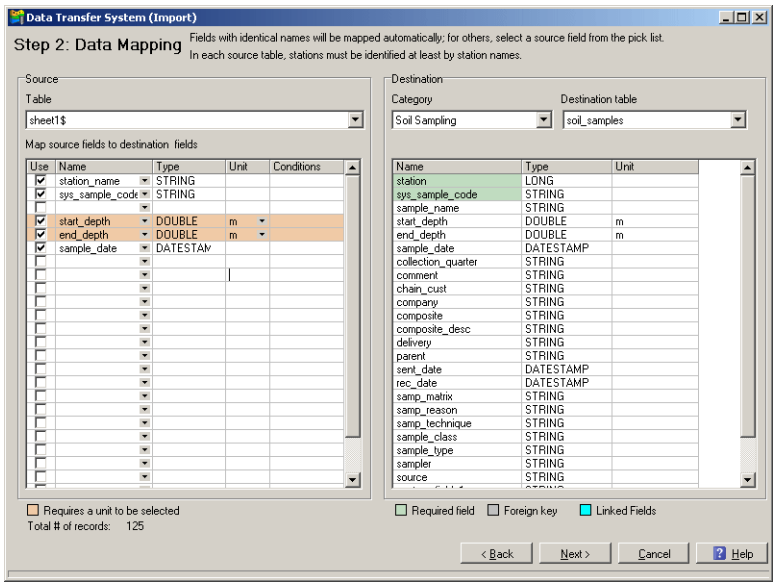
type: Soil sample codes in the box that appears

- ☞ **[OK]**
- ☞ button, beside the **Specify Import File name** field

In the Import File dialog,

- ☞ Change the **Files of type => Excel (.xls)**
- ☞ **Soil_sample_codes.XLS** file, located in the "...\Examples" folder (under the installation folder). The default installation folder is "D:\Program Files\HGAnalyst\Examples".
- ☞ **[Open]**
- ☞ **[Next]** to proceed to the next window in the DTS

In the **Data Mapping** window, you must select a new **Destination Data Category** and **Table** (from the right side of the window). In this case, the soil sample codes will be imported to the **Soil Sampling** category, **soil_samples** table. Select the appropriate items from the combo boxes, as shown in the image below



Under **Destination**,

- ☞ **Soil sampling** for the new **Destination Data Category**
- ☞ **soil_samples** for the new **Destination table**

Under **Source Table**,

- **Sheet1$** (if it is not already selected) from the combo box

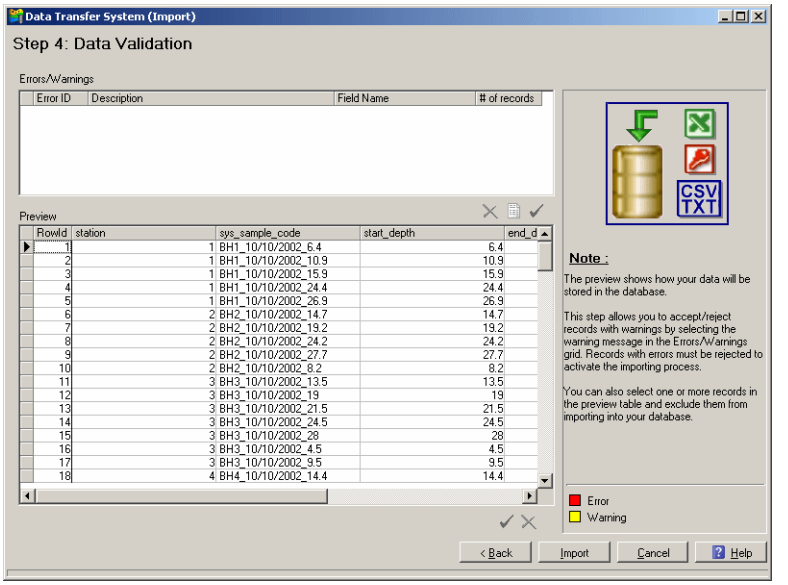
Next, map the fields and select appropriate units. In this example, most fields are automatically mapped, since the field names in the source are identical to the field names in the destination. However, the **station_name** field must be manually mapped, and the units must still be selected for the length field types.

- **m** for the units for the **from_** and **to_** fields
- **Use** for both these fields

Under the **Source**, first row in the table,

- **Station_name** from the combo box
- **[Next]** to continue
- **[Yes]** to continue, in the warning message that appears.

The next window is Data Validation. If you mapped the fields correctly, then your DTS window should appear similar to the one shown below:


Data Transfer System (Import)
Step 4: Data Validation
Errors/Warnings
Error ID
Description
Field Name
# of records
Preview
RowId
station
sys_sample_code
start_depth
end_d
1 1 BH1_10/10/2002_6.4 6.4
2 1 BH1_10/10/2002_10.9 10.9
3 1 BH1_10/10/2002_15.9 15.9
4 1 BH1_10/10/2002_24.4 24.4
5 1 BH1_10/10/2002_26.9 26.9
6 2 BH2_10/10/2002_14.7 14.7
7 2 BH2_10/10/2002_19.2 19.2
8 2 BH2_10/10/2002_24.2 24.2
9 2 BH2_10/10/2002_27.7 27.7
10 2 BH2_10/10/2002_8.2 8.2
11 3 BH3_10/10/2002_13.5 13.5
12 3 BH3_10/10/2002_19 19
13 3 BH3_10/10/2002_21.5 21.5
14 3 BH3_10/10/2002_24.5 24.5
15 3 BH3_10/10/2002_28 28
16 3 BH3_10/10/2002_4.5 4.5
17 3 BH3_10/10/2002_9.5 9.5
18 4 BH4_10/10/2002_14.4 14.4
CSV TXT
Note :
The preview shows how your data will be stored in the database.
This step allows you to accept/reject records with warnings by selecting the warning message in the Errors/Warnings grid. Records with errors must be rejected to activate the importing process.
You can also select one or more records in the preview table and exclude them from importing into your database.
Error
Warning
< Back
Import
Cancel
Help

NOTE: Step 3 is not needed for this data import, since there are no station related settings.

For this example, there should be no errors/warnings present.

- **[Import]** to import the data.

A confirmation message appears stating that the records will be inserted to the database.

- ☞ **[OK]**
- ☞ **[Close]** to close the DTS

The new sample codes should now appear in the project.

Now you are ready to import the soil chemistry analysis results for these sample codes.

Import Chemistry Results

- ☞ **Project > Import > Data** from the main menu.
- ☞ **Package Name**, and select **New Package** from the combo box

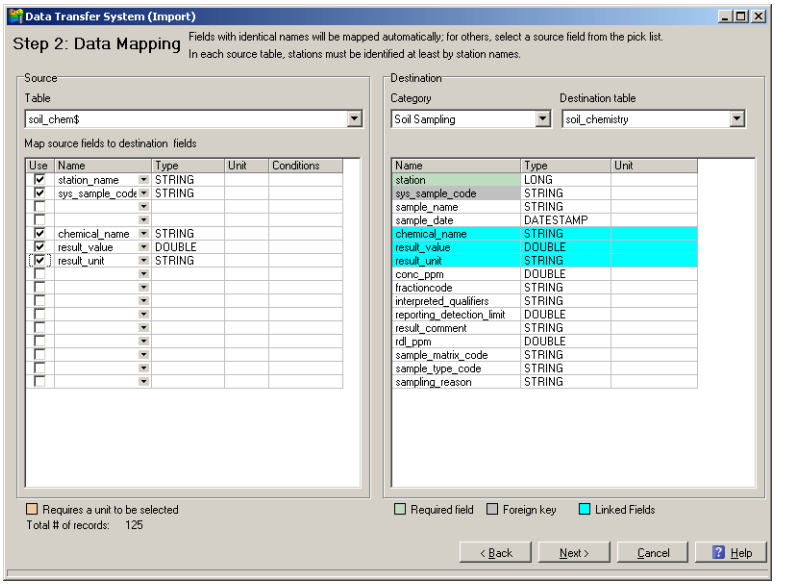
type: Soil chemistry data in the box that appears

- ☞ **[OK]**
- ☞ button, beside the **Specify Import File name** field

In the Import File dialog,

- ☞ Change the **Files of type => Excel (.xls)**
- ☞ **Soil_chemistry_data.XLS** file, located in the "...\Examples" folder (under the installation folder). The default installation folder is "D:\Program Files\HGAnalyst\Examples".
- ☞ **[Open]**
- ☞ **[Next]** to proceed to the next window in the DTS

In the **Data Mapping** window, you must select a new **Destination Data Category** and **Table** (from the right side of the window). In this case, the soil chemistry data will be imported to the **Soil Sampling** category, **soil_chemistry** table. Select the appropriate items from the combo boxes, as shown in the image below



Under **Destination**,

- ☞ **Soil sampling** for the new **Destination Data Category**
- ☞ **soil_chemistry** for the new **Destination table**

Under **Source Table**,

- ☞ **Sheet1$** (if it is not already selected) from the combo box

Next, map the fields and select appropriate units. In this example, most fields are automatically mapped, since the field names in the source are identical to the field names in the destination. However, the **station_name** field must be manually mapped,

Under the **Source**, first row in the table,

- ☞ **Station_name** from the combo box

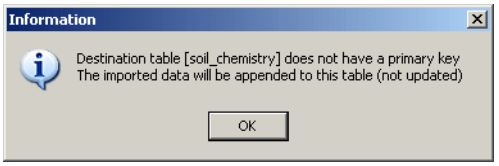
Click on the **result_unit** field,

- ☞ **Use** (if not already selected)
- ☞ **[Next]** to continue

Read the warning message that appears,

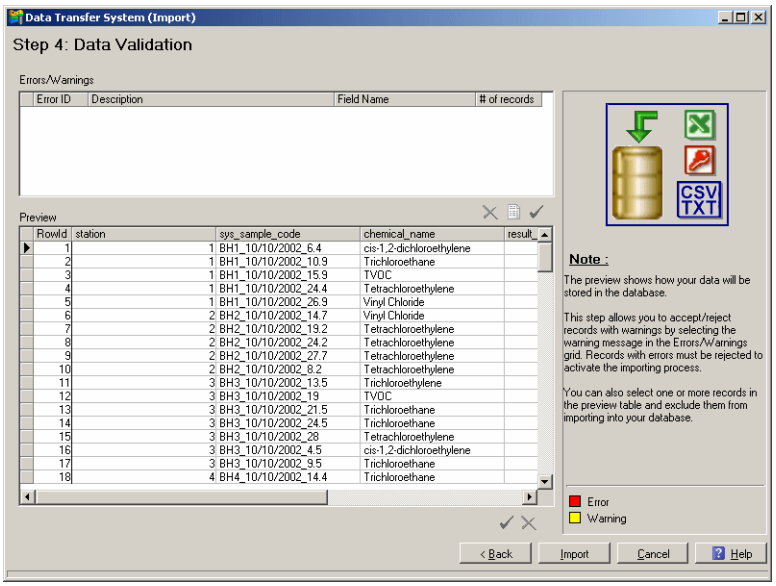
- ☞ **[Yes]** to continue.

A second warning message will appear as shown below.


Information
Destination table [soil_chemistry] does not have a primary key
The imported data will be appended to this table (not updated)
OK

☞ **[OK]** to continue.

The next window is Data Validation. If you mapped the fields correctly, then your DTS window should appear similar to the one shown below:



NOTE: Step 3 is not needed for this data import, since there are no station related settings.

For this example, there should be no errors/warnings present.

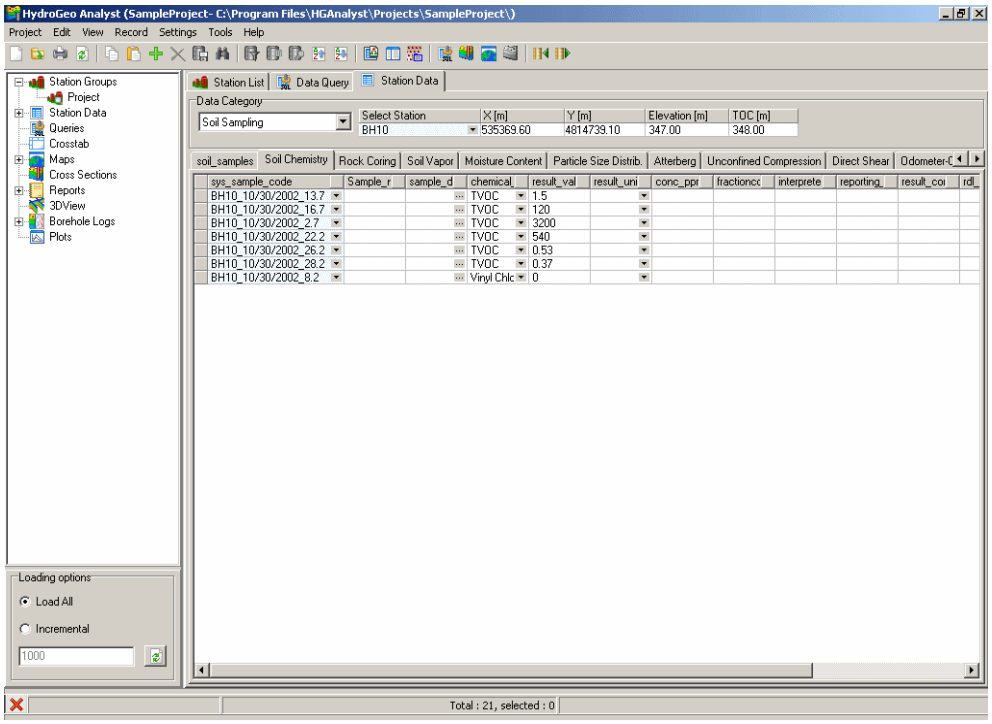
☞ **[Import]** to import the data.

A confirmation message appears stating that the records will be inserted to the database.

☞ **[OK]**

☞ **[Close]** to close the DTS

The chemistry analysis results should now appear in the project. To confirm, select one of the new Boreholes from the **Station List**, load the **Station Data**, and view the **Soil Sampling** data category, **Soil Chemistry** table. An example, for BH10 is shown below:



Since the data was imported directly to the SQL Server database, it is not necessary to Post (Save) the changes.

Example: Importing Water Level Data

In this section, we will import water level data for each station in our HGA project.

In most of the data models provided with HGA, water levels must have an associated Screen Id. When importing the water level data, you need to import the Screen Id first, in the Parent Tree of the database (screen table), THEN import the water level data into the gw_level table (child table).

Import Screen Id

- ☞ **Project > Import > Data** from the main menu.
- ☞ **Package Name**, and select **New Package** from the combo box.

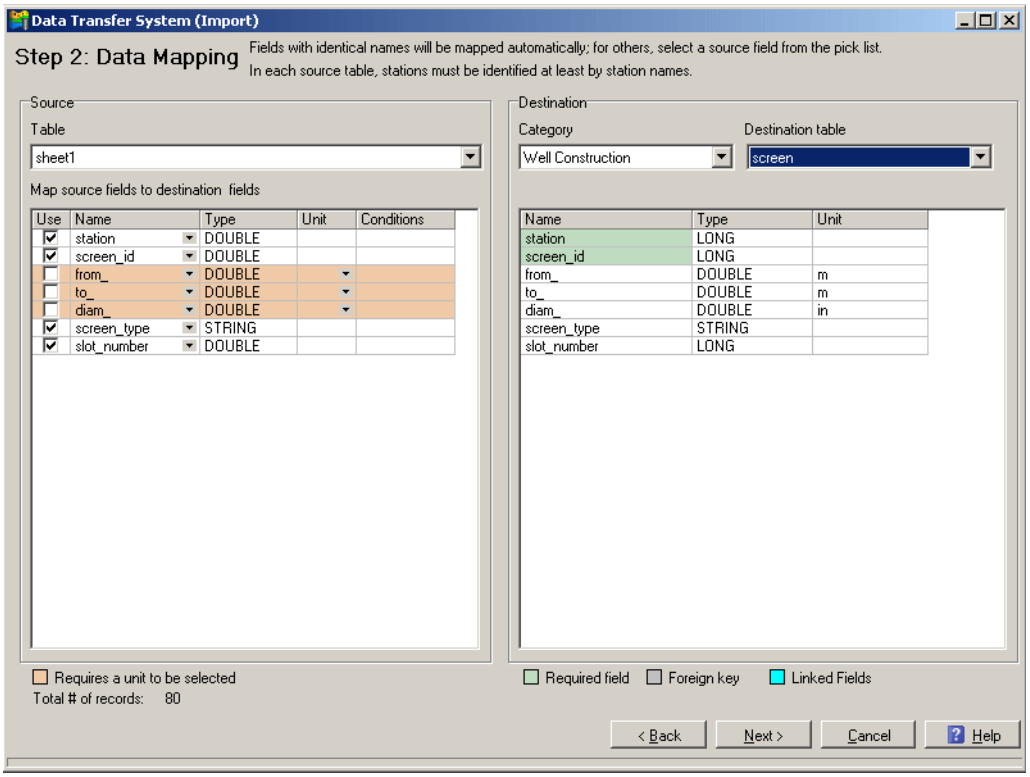
type: **Screen_Id** in the box that appears

- ☞ **[Ok]**
- ☞

In the Import File dialog,

- ☞ Change the **Files of type ==> Excel (.xls)**
- ☞ **screen_id.xls** file, located in the "...\Examples" folder (under the installation folder). The default installation is "D:\Program Files\HGAnalyst\Examples".
- ☞ **[Open]**
- ☞ **[Next]** to proceed to the next window in the DTS.

In the Data Mapping window, you must select a new Destination Data Category and Table (from the right side of the window). In this case, the screen id values will be imported to the **Well Construction** category, **screen** table. Select the appropriate items from the combo boxes, as shown in the image below.



Under **Destination**,

- ☞ **Well Construction** for the new **Destination Data Category.**
- ☞ **Screen** for the new **Destination table**.

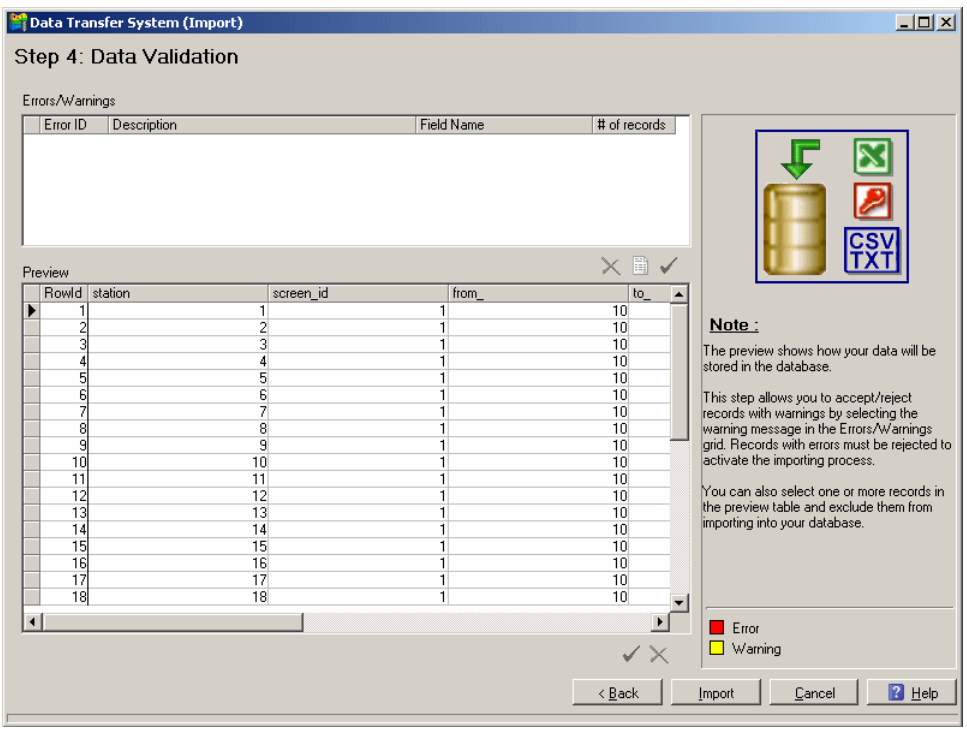
Under **Source Table**,

- **Sheet1** (if is it not already selected) from the combo box.

Next, map the fields and select appropriate units. In this example, most fields are automatically mapped, since the field names in the source are identical to the field name

- **m** for the units for the **from_** , **to_** and **diameter** fields.
- **Use** for these three fields.
- **[Next]** to continue.
- **[Yes]** to continue, in the warning message that appears.

The next window is Data Validation. If you mapped the fields correctly, then your DTS window should appear similar to the one below:



Note: Step 3 is not needed for this data import, since there are no station related settings.

For this example, there should be no errors/warnings present.

- **[Import]** to import the data

A confirmation message appears stating that the records will be inserted into the database.

- **[Ok]**
- **[Close]** to close the DTS.

Now that the Screen Id values have been imported, you can proceed to import the water level data.

Import Water Levels

- **Project > Import > Data** from the main menu
- **Package Name**, and select **New Package** from the combo box.

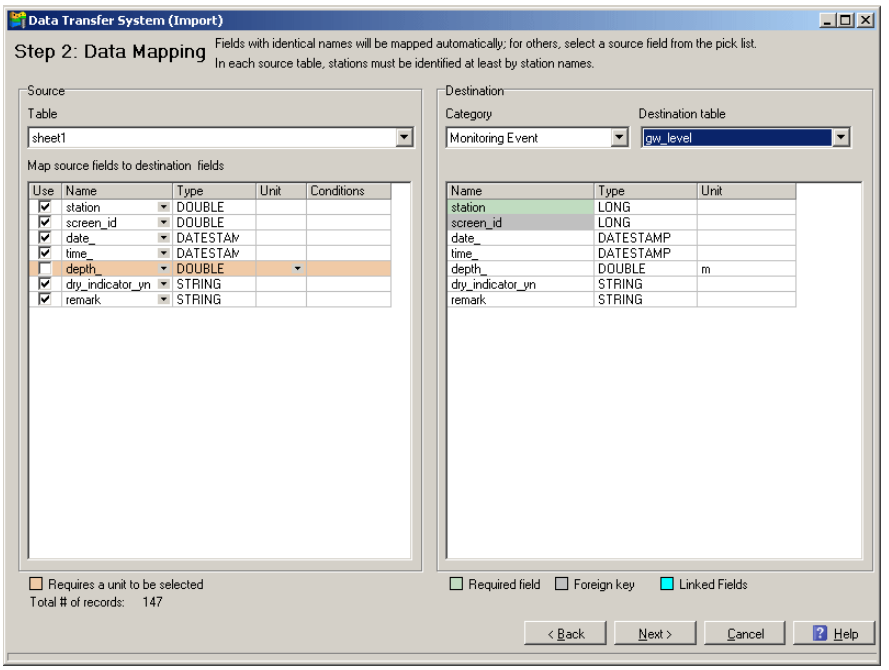
type: **Water Level Data** in the box that appears

- **[Ok]**
- button, beside the **Specify Import File** name field.

In the Import File dialog,

- Change the **Files of type => Excel (.xls)**
- **water_level.xls** file, located in the "...\Examples" folder (under the installation folder). The default installation folder is "D:\Program Files\HGAnalyst\Examples".
- **[Open]**
- **[Next]** to proceed to the next window in the DTS.

In the **Data Mapping** window, you must select a new **Destination Data Category** and **Table** (from the right side of the window). In this case, the water level data will be imported to the **Monitoring Event** category, **Water Level** table. Select the appropriate items from the combo boxes, as shown in the image below.



Under Destination,

- ☞ **Monitoring Event** for the new **Destination Data Category**.
- ☞ **gw_level** for the new **Destination table**.

Under source Table,

- ☞ **Sheet1** (if it is not already selected) from the combo box.

Next, map the fields and select the appropriate units. In this example, most fields are automatically mapped, since the field names in the source are identical to the field names in the destination.

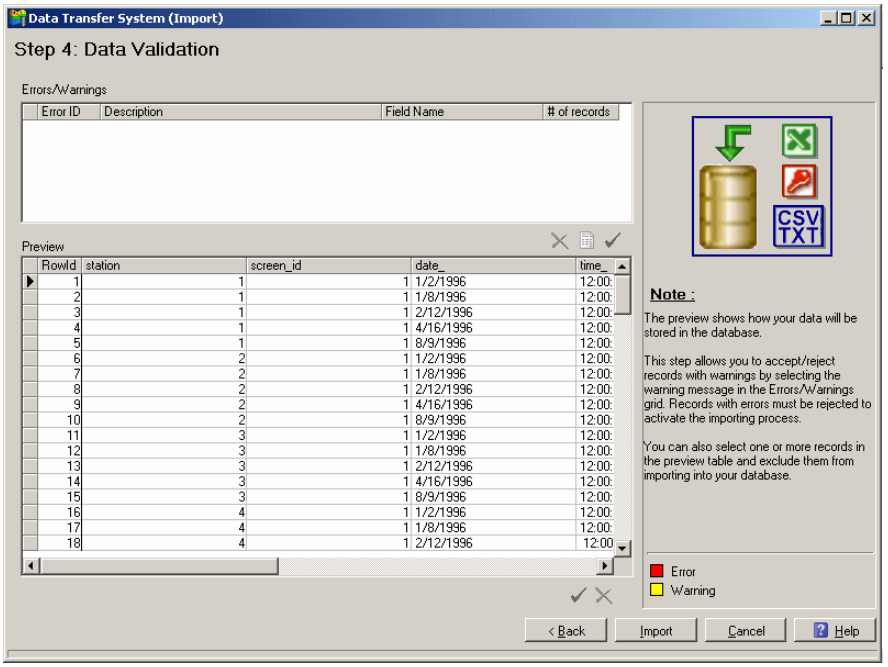
- ☞ **m** for the units for the **depth** field.
- ☞ **Use** for the depth field.
- ☞ **[Next]** to continue

Information
Destination table [gw_level] does not have a primary key
The imported data will be appended to this table (not updated)
OK

- ☞ **[Ok]** to continue, in the information message that appears

The next window is Data Validation. If you mapped the fields correctly, then your DTS window should appear similar to the one shown below:

.


Data Transfer System (Import)
Step 4: Data Validation
Errors/Warnings
Error ID
Description
Field Name
# of records
Preview
RowId
station
screen_id
date_
time_
Note :
The preview shows how your data will be stored in the database.
This step allows you to accept/reject records with warnings by selecting the warning message in the Errors/Warnings grid. Records with errors must be rejected to activate the importing process.
You can also select one or more records in the preview table and exclude them from importing into your database.
Error
Warning
< Back
Import
Cancel
Help

NOTE: Step 3 is not needed for this data import, since there are no station related settings.

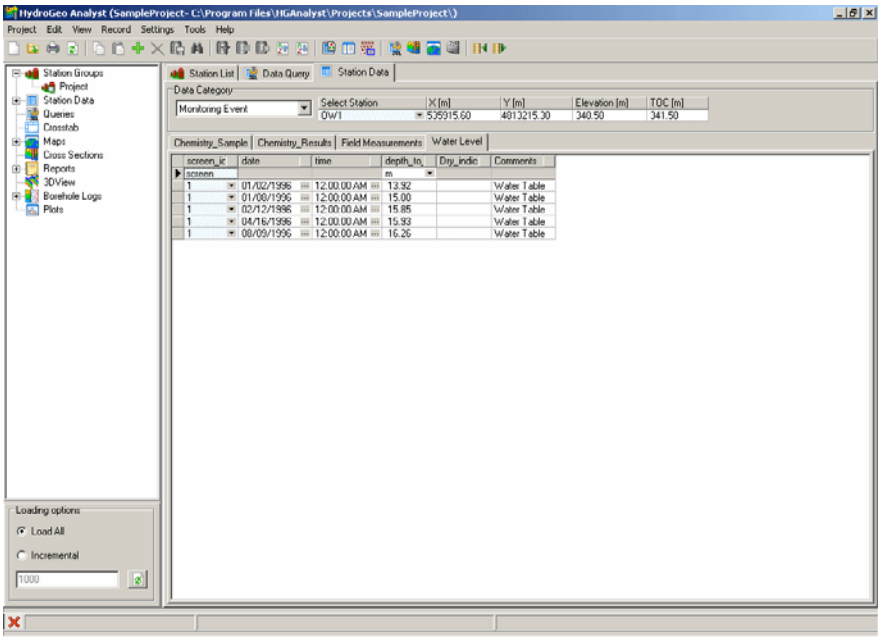
For this example, there should be no errors/warning present.

- ☞ **[Import]** to import the data.

A confirmation message appears stating that the records will be inserted to the database.

- ☞ **[Ok]**
- ☞ **[Close]** to close the DTS.

The water level data should now appear in the project. To confirm, select one of the Boreholes from the **Station List**, load the **Station Data**, and view the **Monitoring Event** data category, **Water Level** table. An example for **OW1** is shown below:



Using the HGA Lab Quality Control tools, you may now perform a quality control assessment on your data, analyzing blanks, duplicates, and spike samples. This feature is outside the scope of this exercise. For more details, please see Chapter 13: Quality Control.

2.2.3 Creating Station Groups

Once the data has been successfully entered into the project, it may be convenient to sort the stations into logical groups. Grouping stations allows for efficient management and quick retrieval of data stored in the database.

Station groups can be created based on any criteria. Common examples include:

- Locations of the stations (e.g. locations sorted by City, Project Sites, etc.)
- Station type (e.g. Monitoring Locations, Boreholes, etc.)
- Purpose of Study (e.g. remediation, site monitoring)

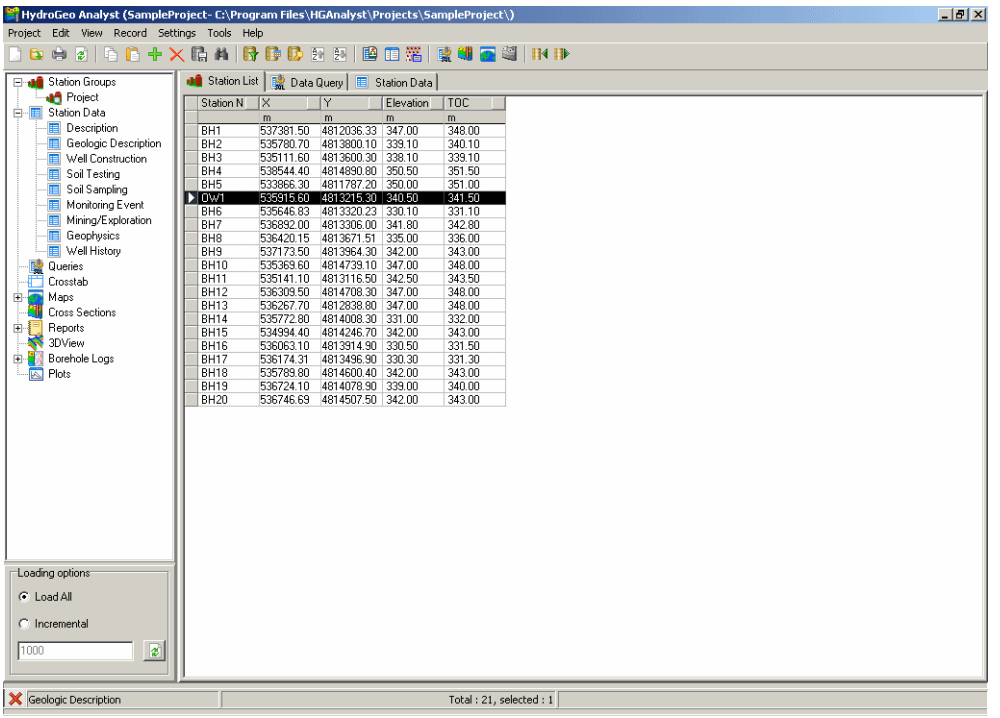
All station groups created for a project are listed in the Project Browser under the **Station Groups** node. Clicking any of the sub-nodes corresponding to a station group will display the appropriate stations belonging to that group in the **Station List** tab.

Station Groups can be created manually or through the use of the Query Builder. The following example demonstrates how create a station group manually, containing the Borehole stations.

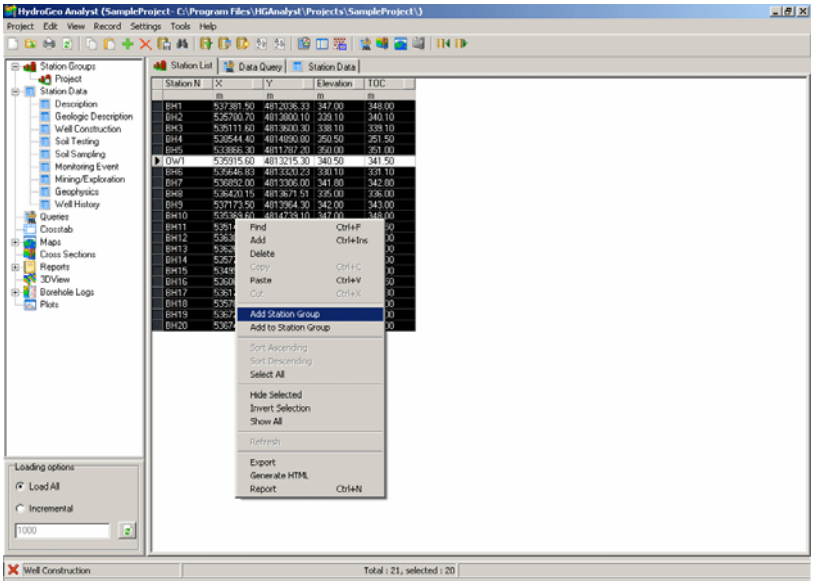
Example: Creating a Station Group

To create a Station Group:

- ☞ **Station List** tab
- ☞ **OW1** (ensure this row becomes highlighted, similar to the image shown below)



- ☞ **Record > Invert Selection.** This will highlight all the Boreholes, and de-select the observation well (OW-1).
- ☞ Right-click on any of the selected Boreholes, and select "**Add Station Group"** as shown below



In the dialog that appears, enter a name for the new station group.

type: Boreholes

☞ **[OK]**

The selected stations will be added to the new group “Boreholes”, and this Station Group will appear as a new node (branch) in the Project Browser. These stations will also remain in the **Project** Station Group.

Once the stations in a group are displayed, a number of actions can be taken based on the selection. For example, loading a station group and then activating the mapping component will automatically create a GIS layer containing all stations from this group. This option will be demonstrated later in this chapter.

2.3 Viewing Borehole Log Plots

In this section, you will see how to create a Borehole Log Plot (BHLP) for one of the stations.

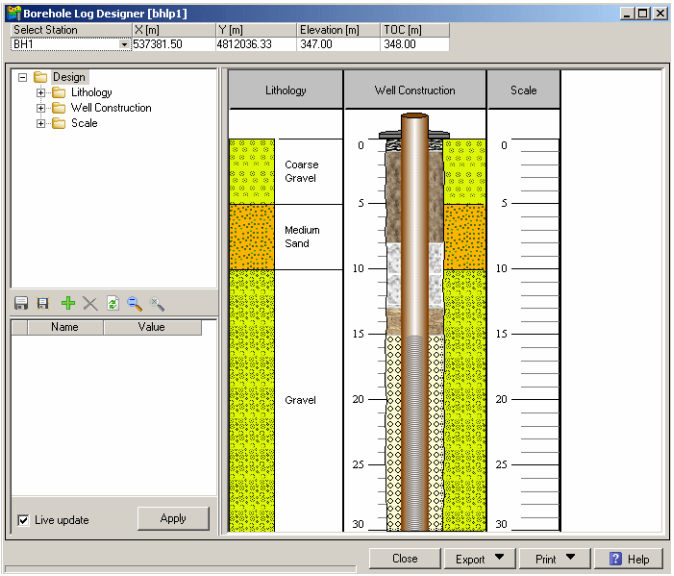
☞ **Boreholes** station group

☞ **BH1** station, since this station contains data for well construction, casing, screens, etc.

Next, locate the **Borehole Logs** node in the Project browser.

☞ **+** beside Borehole Logs, to expand this node

☞☞ Double-click on **WHI1 (BHLP1)**, to load this Borehole Log Plot template. The BHLP will appear, similar to the following figure.



This BHLP template contains a pre-defined structure with Lithology, Well Construction, and Scaling information. The BHLP Report may be exported to an XML file, printed directly, or saved in several formats including .HTM, .PDF, .XLS, etc.

For more details, please see Chapter 12: Borehole Log Plotter.

To proceed with this exercise,

☞ **[Close]** button to close the BHLP window

2.4 Querying the Database

Once the data has been successfully entered into the project, the Query Builder may be used to run queries on the station data. Queries provide the ability to search and find a specific set of data or stations, quickly and easily. Some examples of this application include:

- Finding stations located in a specific area of your site (search by X, Y location).
- Searching Monitoring event data, for groundwater chemistry samples which exceed a guideline level.
- Finding all wells which exceed a specified depth

In addition, using the Query Builder you can create Data Queries that provide the data sources for:

- Map Layers (see Chapter 8: for more details)

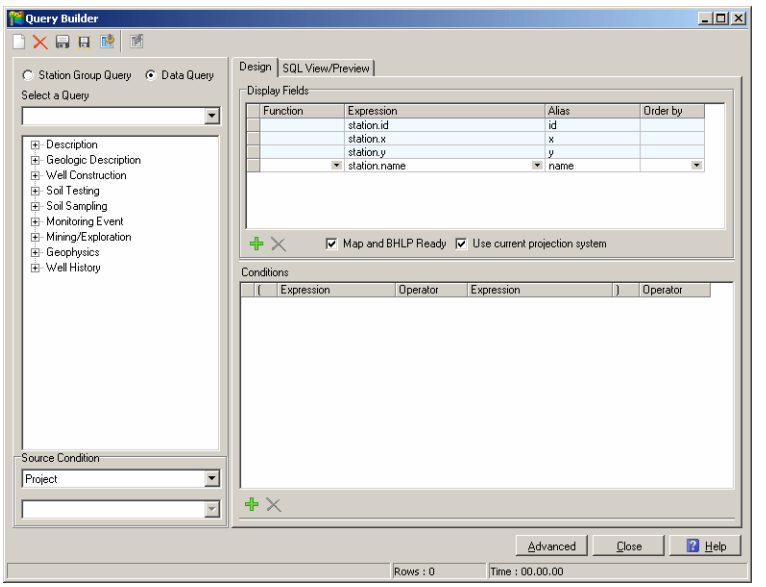
- Cross section interpretation results (see Chapter 9: Querying Cross Section Interpretations for more details)
- Quality Control Analysis (see Chapter 13: Applying a Lab Quality Template for more details)
- BHLP columns (see Chapter 12: Specify Data Source for more details)
- Crosstab reports (see Chapter 7: Crosstab Queries for more details)
- 3D plume projects (see Chapter 3: 3D Interpolation for more details)
- Charts (see Chapter 14: Adding Plots for more details)
- Customized Reports (see Chapter 11: Creating Reports based on a Data Query for more details)

2.4.1 Example: Querying the Database

In this example, you will create a data query that returns all stations that have soil chemistry exceedences for PCE (Tetrachloroethylene).

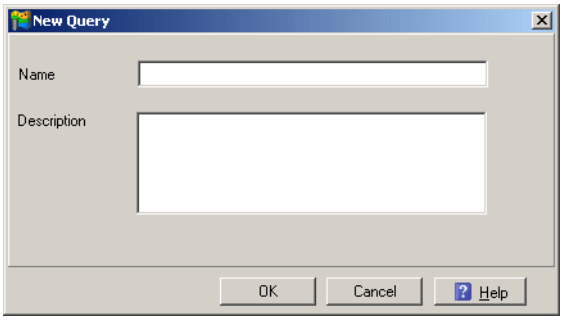
Follow the directions below to build a simple query:

☞ **Tools > Query Builder** from the main menu, or click on the button from the toolbar. The **Query Builder** window will load as shown below.



☞ **Data Query** as the type, in the upper-left section of the window

☞ (New Query) button in the toolbar.



In the dialog that appears, enter a **Name** for the new query. For this example,

type: PCE_exceedences

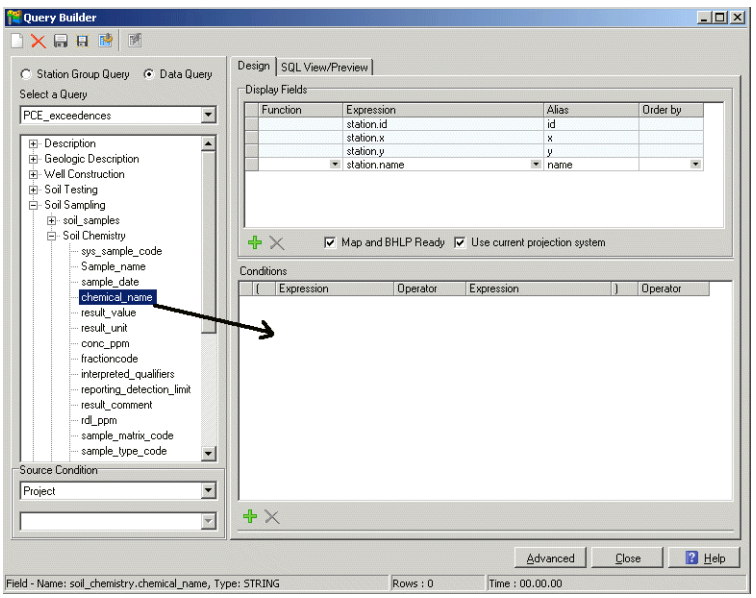
☞ **[OK]**

The Project Tree on the left side of the window contains the database structure, with the data categories, tables, and fields. For this example, expand the **Soil Sampling** category, then the **Soil Chemistry** table, and locate the **chemical_name** field.

☞ **+** beside **Soil Sampling**

☞ **+** beside **Soil Chemistry**

An example is shown below:



☞ Click once on the field, and drag this field into the **Conditions** frame.

The selected field will be added automatically to the Query Conditions. Alternately, you may use the (Add) button (on the bottom half of the window) to add conditions, then define them manually.

Under the **Conditions** frame, select an **Operator** for the field. A combo-box with several options will appear: >, >=, <=, <, =, <>, !=, !>, !<, LIKE, IS, IS NOT, &, !. For this example,

- ☞ = (equals symbol) from the combo box

Next, enter a value in the second **Expression** field. For this example,

- ☞ Tetrachloroethylene from the combo box

In addition, add the chemical_name field to the **Display** fields in the upper frame.

- ☞ Click once on this field, and drag this field into the **Display Fields** frame.

Next, you must enter the result value field. From the project tree on the left side of the window, locate the **result_value** field.

- ☞ Click once on the **result_value** field, and drag this field into the **Conditions** frame.

Under the **Conditions** frame, select an **Operator** for the field. A combo-box with several options will appear: >, >=, <=, <, =, <>, !=, !>, !<, LIKE, IS, IS NOT, BETWEEN, &, !. For this example,

- ☞ **>** (greater than symbol) from the combo box

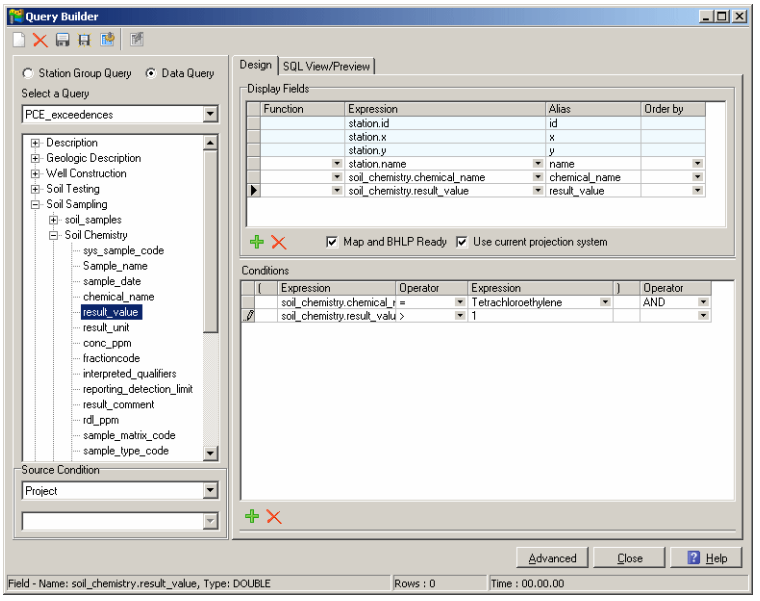
Next, enter a value in the second **Expression** field. For this example,

type: 1

In addition, add this field to the **Display** fields in the upper frame.

- ☞ Click once on the **result_value** field, and drag this field into the **Display Fields** frame.

Once the fields have been added, the Query Builder display should be similar to the one shown in the figure below.

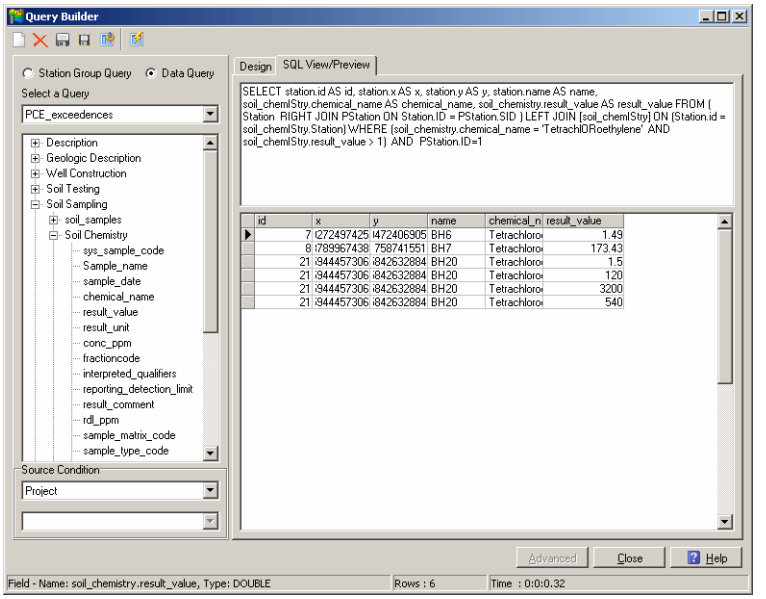


☞ (Generate SQL Statement) button from the toolbar at the top of the window to Generate the SQL string. If the Query string is invalid, the violating rows will be highlighted red (indicating error) or yellow (indicating warning).

☞ (Execute SQL Statement) button at the top of the window to execute the query string.

If not already active,

☞ **SQL View > Preview** tab to see the results of the Query. The results should be similar to that shown in the figure below:



- (Save Query) button to save the query
- **[Close]** to return to the main HydroGeo Analyst window

This query will now appear as a new node under the **Queries** branch of the Project Browser.

A warning message may appear, stating “Do you want to save changes made to the Station List”.

- **[Yes]** to save and proceed.

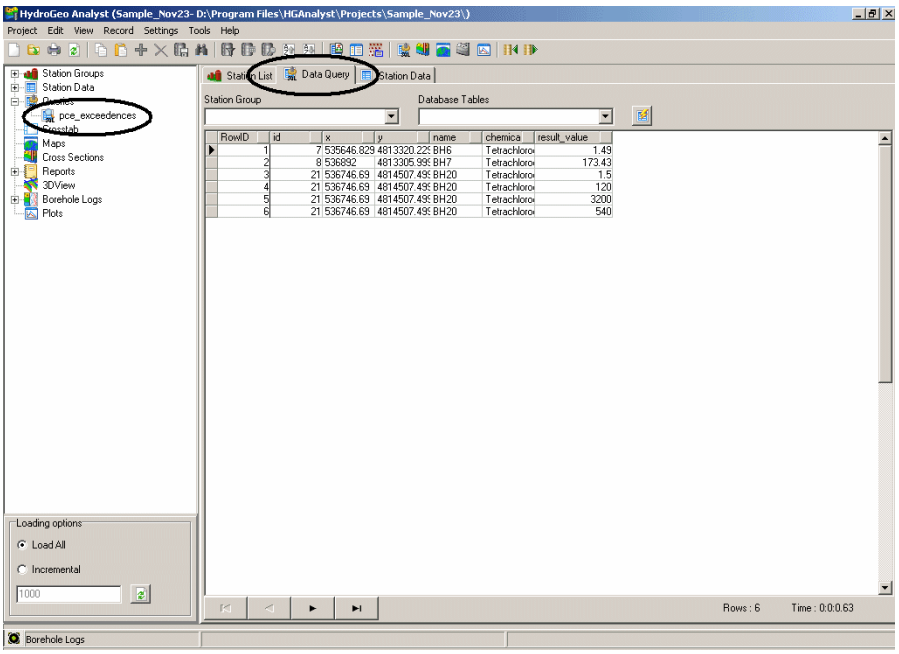
2.4.2 Recalling and Executing Queries

Once a query has been created, it will remain available from the main HydroGeo Analyst interface.

A Station Group Query will appear as a branch under the **Station Group** node in the project browser. The stations which satisfy the query will be automatically added to this new Station Group.

A Data Query will appear as a new branch under the **Queries** node in the project browser.

To see the results of a selected query, right-mouse click on the query and select **Execute** option. The Query results will then be displayed in the Data Query tab, as shown in the example below.



With this data query, you now have the option to generate a Crosstab query report. This feature is outside the scope of this exercise. For more details, please see Chapter 7: Crosstab Queries for more details.

If you have time-varying data for one or more contaminants in your database, you may generate data queries with these fields then generate Time Series charts. This feature is outside the scope of this exercise. For an example of how to create charts, please see Chapter 14: Adding Plots.

In the next section, you will create a map project, and display some of the boreholes on the map.

2.5 Mapping the Data

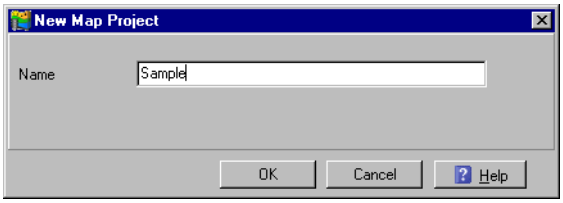
Once the data has been entered into a HydroGeo Analyst project, quite often it is helpful to relate this data to features on a base map, and create contour maps or thematic maps (Pie or Bar charts) for interpreting the data. This can be done using the Map Manager. The first step is to create a new map project.

2.5.1 Creating a Map Project

In this section, the Borehole stations will be loaded onto a new map project. To create a new map project,

☞ **Tools > Map Manager** or right click on the **Map** node, and select **New**.

A prompt will appear to enter a name for the new map project, as shown below

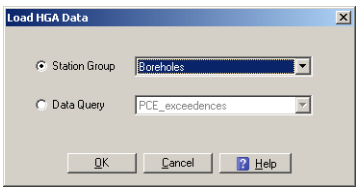


type: Sample

☞ **[OK]**

A new Map window will appear. To load the stations from HydroGeo Analyst on to the map project,

☞ **Layer > Load HGA Data** from the menu in the Map Project window. The following window will appear.

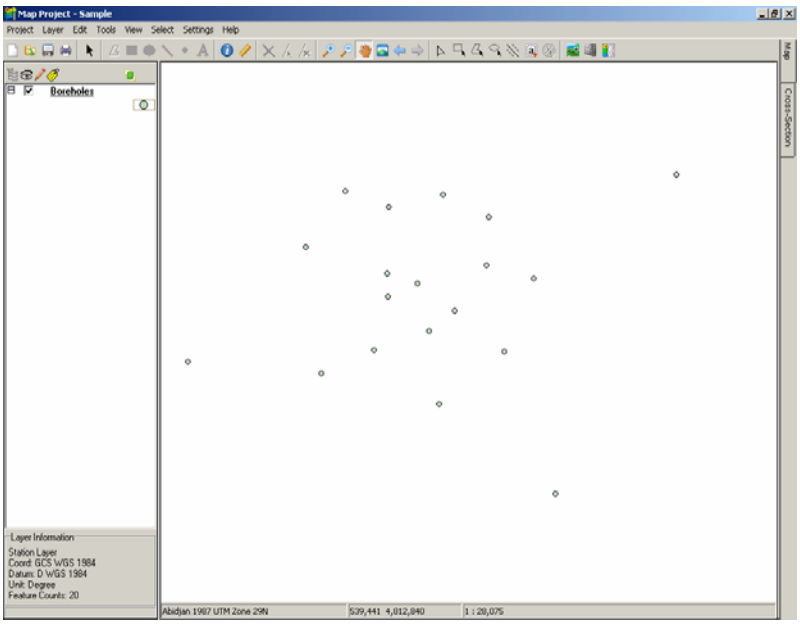


Use this option to load Station Groups or Map Ready Data Queries into your map project.

Ensure the **Boreholes** Station Group is selected.

☞ **[OK]**

The Borehole Stations will then be plotted on the Map in the **Map Project** window, as shown below:



Note: By default, Map Manager uses the projection system that is defined in the project settings (*"Step 3: Set Project Properties and Location" on page 32).* You can change the projection system by clicking on **Project > Properties**, and selecting a new projection from the dropdown menu list.

In the **Map Project**, you may create a new map layer that contains a map image, from any of the following sources:

- Raster Images (*.BIL, *.TIF, *.GRC, *.BMP, *.JPG, *.TGA)
- AutoCAD files (*.DWG, *.DXF), or
- MicroStation files (*.DGN)

This feature is demonstrated in the next section.

2.5.2 Importing and Georeferencing a Site Map

An example of how to import a map is provided below.

☞ **Layer > Import > Raster** from the Map Project main menu.

☞ **Sample_Map.bmp** file, located in the folder "D:\Program Files\HGAnalyst\Examples".

A warning message will appear verifying that the image must be georeferenced.

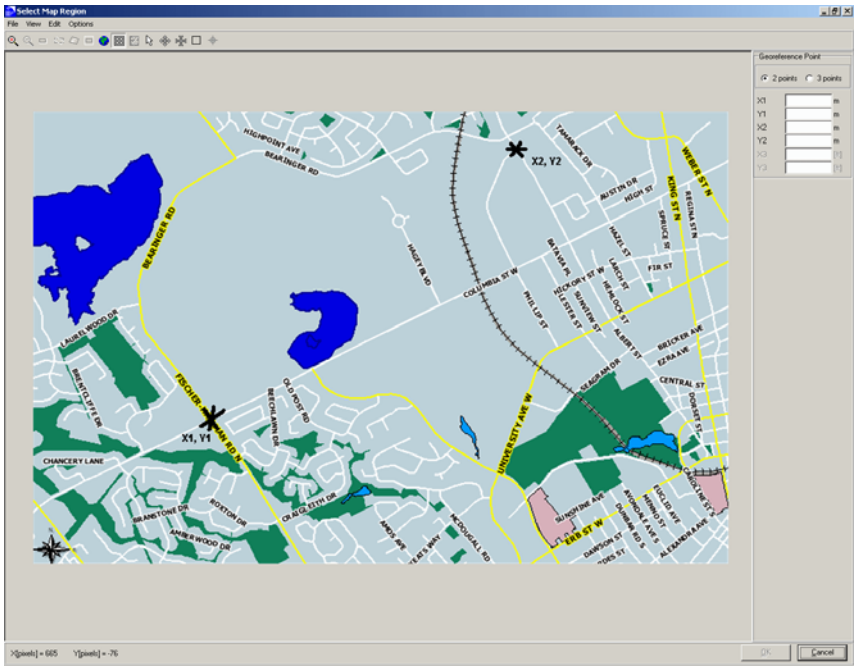
☞ **[Yes]** to continue.

A prompt will appear to define a name for the new site map.

Enter the name: Sample_Map_GR.bmp (where GR indicates that the image will be georeferenced).

☞ **[Save]** to continue.

The Georeference window will appear as shown below.



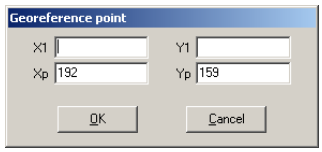
In order to map the pixels of the image to a coordinate system, the image must have at least two georeference points with known coordinates. A third georeference point can be used to improve accuracy. However, for demonstration purpose, only two points will be used in this guide. These georeference points must be assigned as described below.

Adding Georeference Points

To set the georeference point,

☞ Click on the first map location where the world coordinates are known. For this image, the points for X1, Y1 and X2, Y2 are marked with an * on the map.

A **Georeference point** window will appear prompting for the X1 and Y1 world coordinates of the selected location. **Note**: The world coordinates **must** be in the projection system that the map project is set to.



Enter the following coordinates for this point:

- **X1 =** 535122
- **Y1 =** 4812839
- **[OK]**

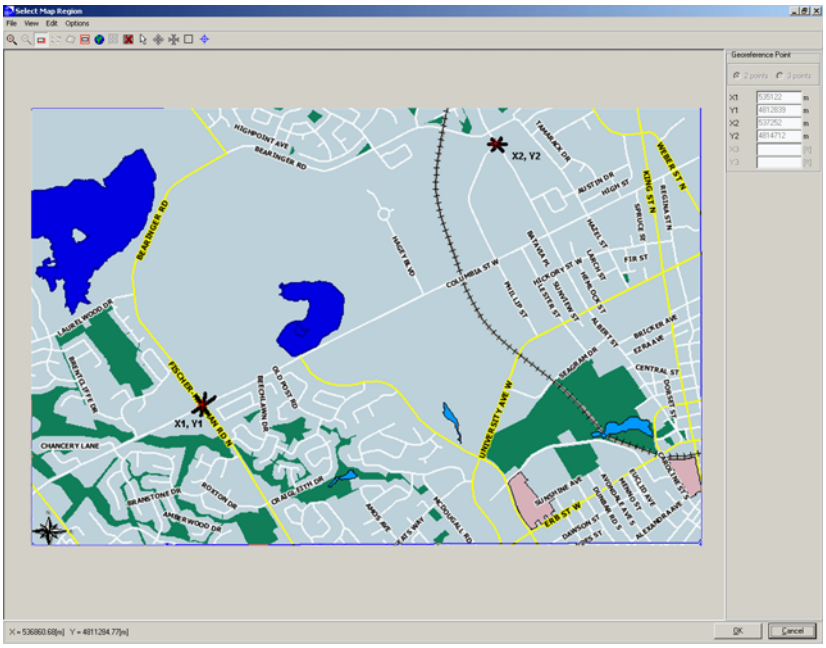
Click on the second map location where the world coordinates are known. This point is marked with an * on the map as X2, Y2, in the upper right corner.

Enter the following coordinates for this point:

- **X2 =** 537252
- **Y2 =** 4814712
- **[OK]**

The image is now georeferenced. Next, in order to use the full map window, you must maximize the extents.To do so,

- **Options > Full Region** in the Georeference Window; the window should now appear similar to the figure shown below

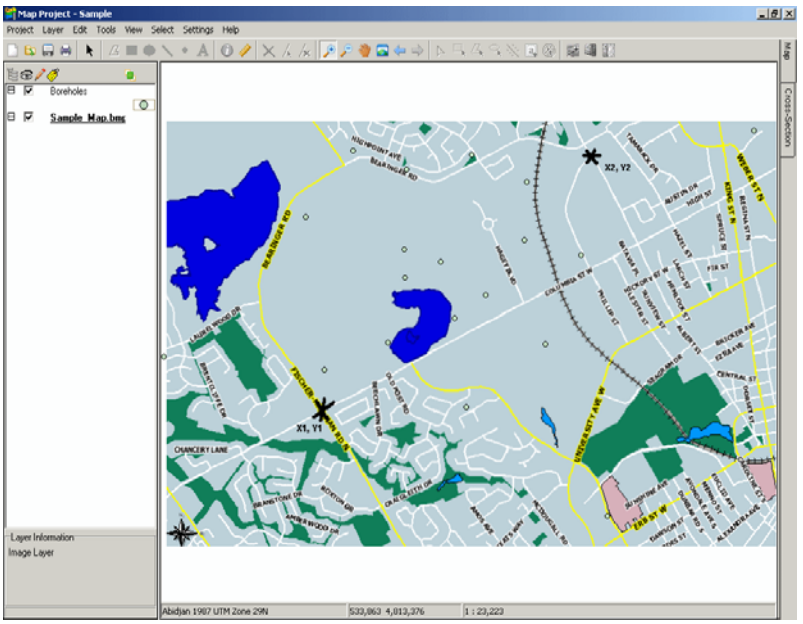


- ☞ **[OK]** in the **Select Region** Window. This will close the Georeference window.
- ☞ **[OK]** in the **File Attributes** window.
- ☞ **[OK]** in the **Confirmation** window, stating the image was georeferenced successfully.

The Raster Image now appears as a new Map Layer in the Map Project. However, it will appear at the top of the Layer Manager panel, and as a result, will hide the Boreholes station group layer. Therefore, the new map layer must be moved down. To do this,

- ☞ Using the mouse, drag-and drop the SiteMap layer onto the Boreholes layer.

After doing this, the Boreholes station group layer will be displayed on top of the site map, as seen in the figure below.

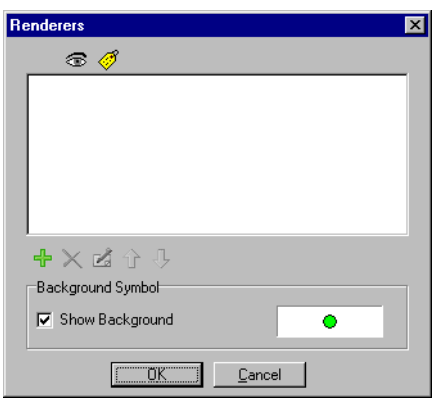


At this time, feel free to experiment with the properties of the Boreholes layer, by modifying the symbol properties.

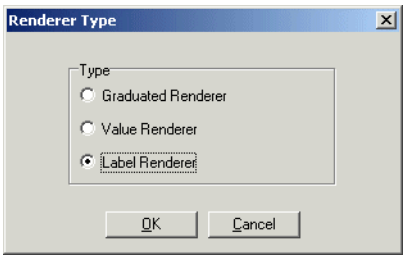
Adding Labels

To add labels to the Boreholes,

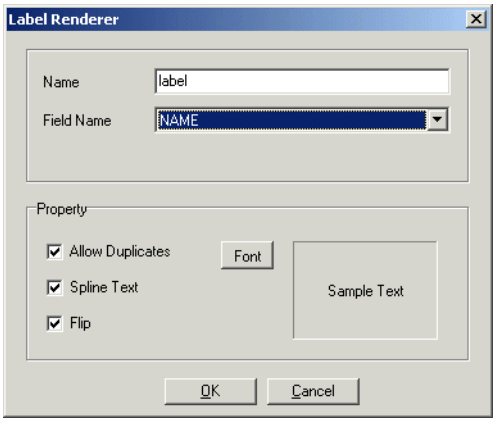
☞ **Layer > Renderer** from the main menu of the Map Project window. The Renderers dialog will appear.



☞ (Add) button to add a new renderer, and the following dialog will appear with the available Renderer types.



- **Label Renderer**
- **[OK],** and the following dialog will appear.



type: Label for the **Name**

- **Name** for the **Field Name**
- **[OK]** to close the **Renderer type** window
- **[OK]** again to close the **Renderers** window

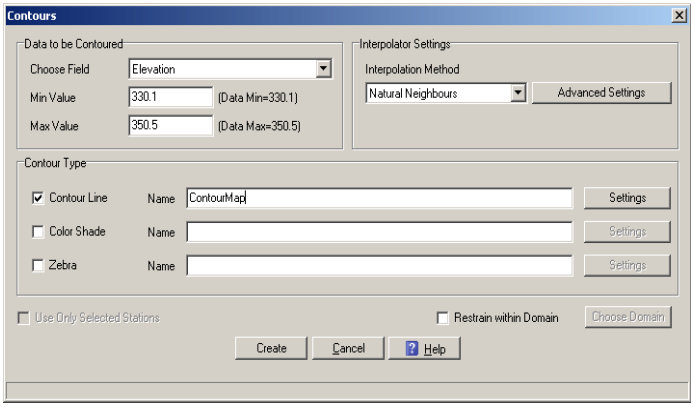
The stations will now be identified with the appropriate label.

2.5.3 Creating a Contour Map

Contour maps may be created to quickly visualize a measured result value (soil or groundwater concentrations) or elevations (surface or water table) data. In this example, you will create a contour map of the surface (ground) elevations.

- **Boreholes** layer from the Layer Manager panel to ensure that the data layer is active. If the layer is active, it will appear with a baby-blue background in the layer control.

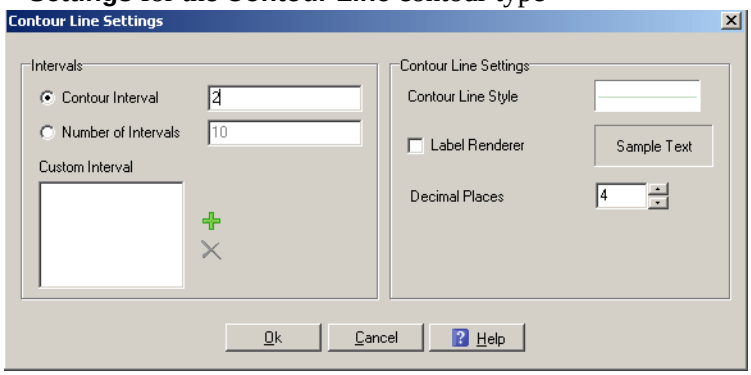
☞ **Layer > Create Contours** from the **Map Project** main menu. A **Contours** dialog will appear, as shown in the following figure:



☞ **Elevation** from the **Choose Field** combo box at the top of the dialog

type: ContourMap in the **Name** textbox**.**

☞ **Settings** for the **Contour Line** contour type



In the **Contour Line Settings** dialog,

type: 2 for the **Contour Interval**

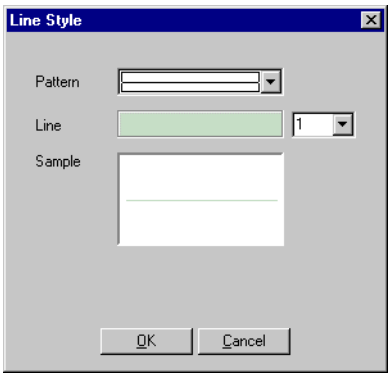
☞ **[Ok]**

☞ **[Create]**

.

The contour map will now show up as a new map layer in the map project. The contour map properties may be modified, including the line thickness and color. To do so,

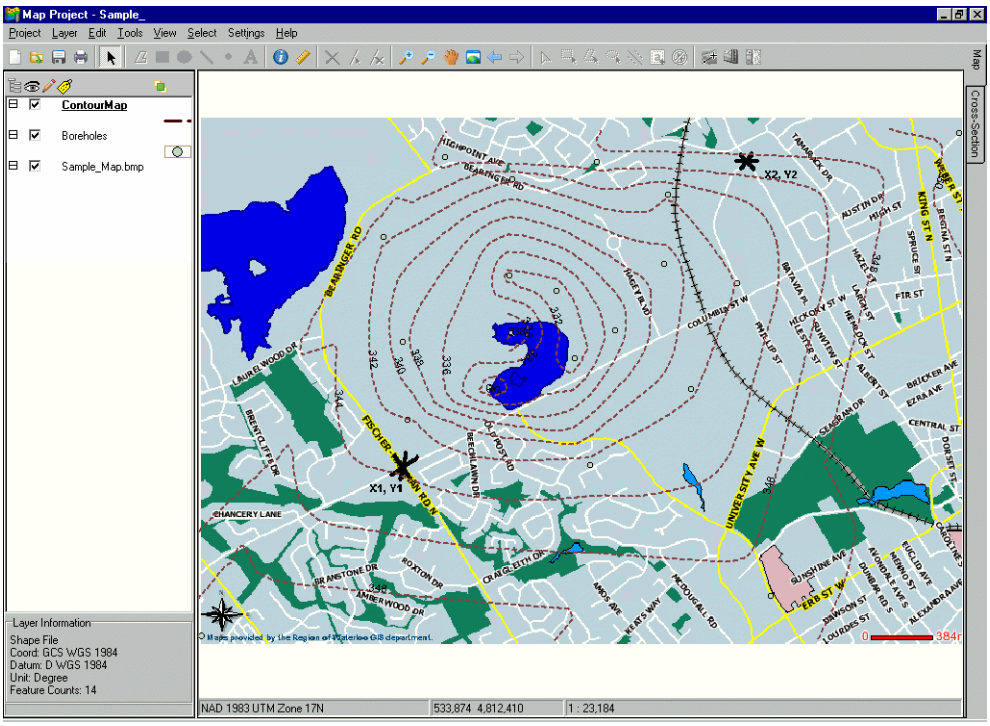
- ☞ **ContourMap** layer in the Layer Manager panel, to make this active.
- ☞ **Layer > Properties** from the menu. The following dialog will appear:



Feel free to experiment with the line properties. It may be helpful to change the color and line thickness. Once you are finished:

- ☞ **[OK]** to apply the new properties.

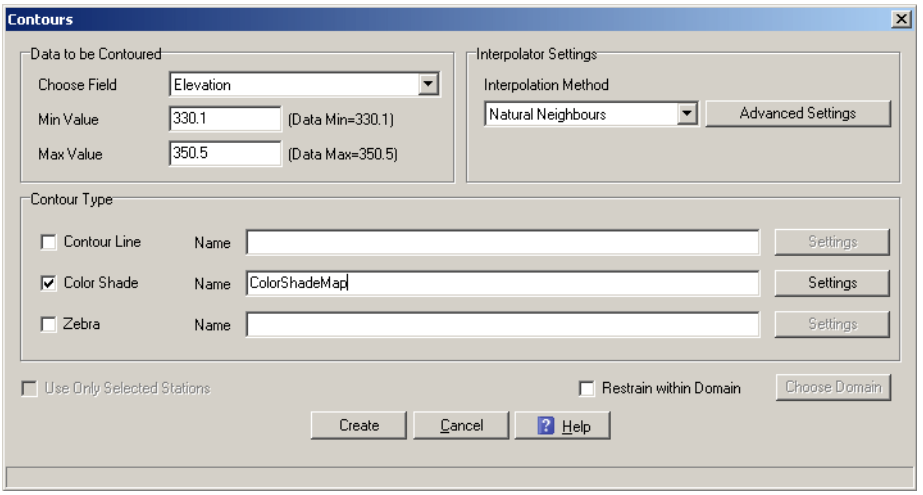
The map project with the contour map should now be similar to the one shown in the figure below.



2.5.4 Creating a Color Shade Map

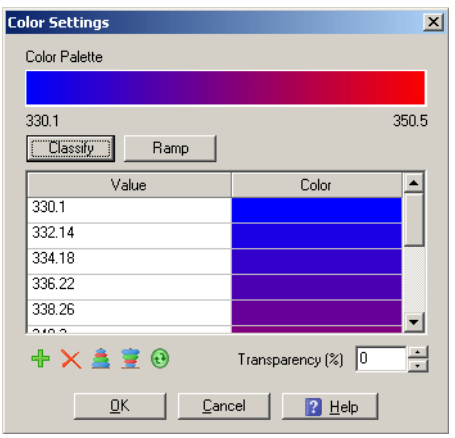
Color Shade maps may be created to further visualize a measured result value (soil or groundwater concentrations) or elevation (surface or water table) data. In this example, you will create a color shade map of the surface (ground) elevations.

- ☞ **Boreholes** layer from the Layer Manager panel to ensure that the data layer is active.
- ☞ **Layer** > **Contours** from the **Map Project** main menu. A Contours dialog will appear, as shown in the following figure:



- **Elevation** from the **Choose Field** combo box at the top of the dialog
- **Contour Line** checkbox to disable this contour type.
- **Color Shade** checkbox to enable this contour type.

  type: ColorShadeMap in the **Name** textbox**.**
- **Settings** for the **Color Shade** contour type



The **Color Settings** Renderer allows you to define different colored zones/ranges according to their specific interval of values. You can use the **[Classify]** button to set the number of intervals. HGA will automatically divides the available range of values into that number of equal intervals. Use the **[Ramp]** option to define the color palette.

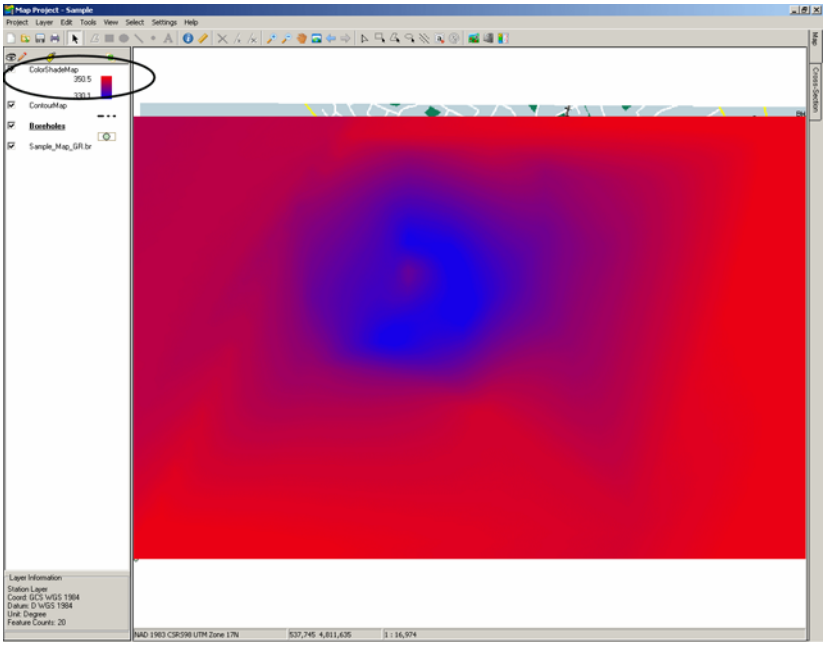
You can experiment with different classifications and color schemes. For demonstration purposes, lets keep the default settings.

- **[Ok]** button to exit the Color Settings dialog.

☞ **[Create]** button

A message will display indicating that the color shade map was successfully generated.

☞ **[Ok]** button

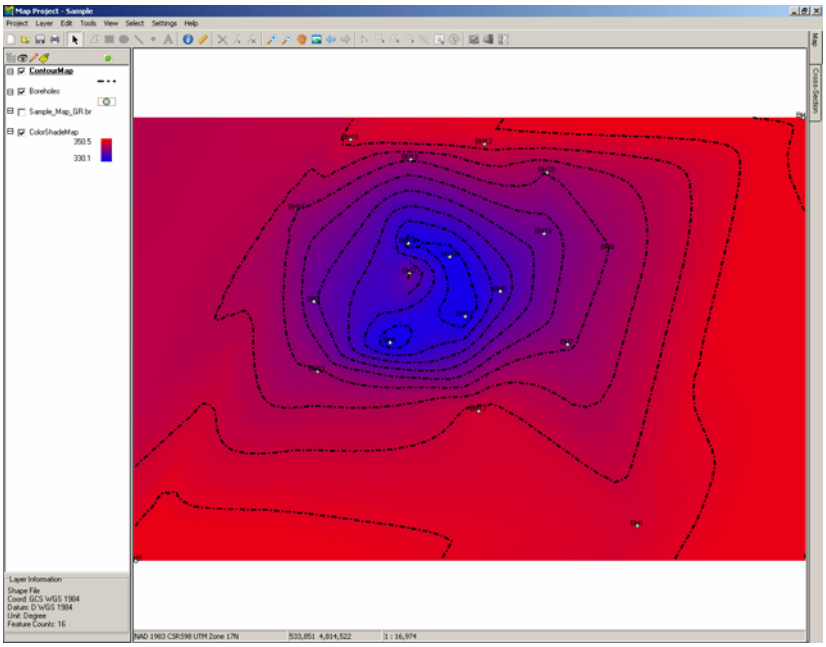


By default, the new color shade map layer will appear at the top of the Layer Manager panel and as a result, cover up the other layers. From the Layer Manager panel,

☞ Using the mouse, drag-and-drop the color shade layer onto the Boreholes layer.

☞ Disable the SiteMap_gr.bmp layer by unchecking its visibility checkbox.

When used with contour lines, the color shade map layer allows you to easily visualize detailed information about the surface elevation in our area of study (shown below).



2.5.5 Defining Cross Section Lines

The Map Manager also provides an interface for drawing and defining the locations of cross-sectional lines. Since the Map Manager provides a plan view of station data, it is a simple task to draw lines in the location(s) of the desired cross-section(s). Cross Section lines are defined using the CrossSection Line option. A line is drawn through the desired stations, then a buffer distance is provided to specify which stations to include. A large buffer distance will result in selecting stations further away from the line; a small buffer distance means that only stations close to the line will be selected. Only the stations within this buffer distance become highlighted and selected for the cross section interpretation. The cross section may then be created using these selected stations.

An example is provided below on how to define a cross-section line in the Map Manager.

Before proceeding, hide the ContourMap, as it will no longer be needed.

- **ContourMap** layer from the Layer Manager panel
- Remove the check mark for the Visible status for this layer. This layer will now be hidden from the view. Do the same for the **ColorShadeMap** layer.
- **Boreholes** layer from the Layer Manager panel, to ensure that this layer is active.

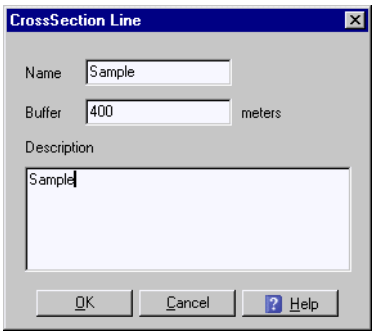
HINT: In order to activate the cross-section options, a layer that contains Station data must be selected.

☞ (Cross-Section Line) button from the toolbar

☞ Place the mouse cursor near the top left corner of the map, and click once with the left mouse button to start the line.

☞ Drag the mouse across the map, to the bottom right corner of the map, passing in between some of the stations as you draw the line.

☞☞ Double click with the mouse near the bottom right corner of the map, to finish the line. This will launch the dialog shown below:



☞ In this dialog, specify a **Name, Buffer Distance** and **Description** (optional). The **Buffer Distance** determines which stations will be included in the cross section.

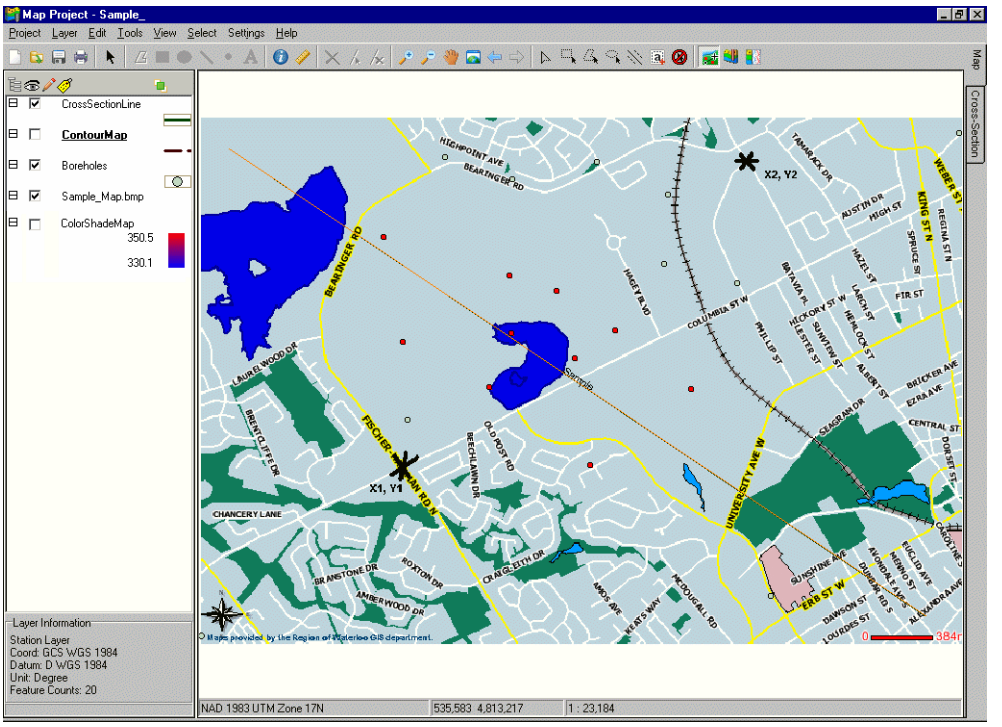
type: Sample for the line **Name**.

type: 400 m for the **Buffer** Distance.

type: Sample for the **Description**

☞ **[OK]** to accept the Line attributes.

The Cross Section line will now appear in the Map Manager, and will be labeled with the Cross Section Line name. In addition, a new layer will appear in the Layer Manager panel, named “CrossSectionLine”. This is a line shape layer, containing the cross section lines for the project.



Those Borehole stations that lie within the 400 m **Buffer Distance** will be selected (as indicated by a red circle on top of the station's symbol) and included in the cross-section. (The Buffer Distance is projected perpendicular to the cross-section line).

2.5.6 Creating the Cross Section

Once the cross-section line is defined, the corresponding cross-section can be created:

- **Tools > Create Cross Section** from the main menu, or click on the **Show/Create Cross Section** button on the toolbar (this button is located beside the Cross Section line button).

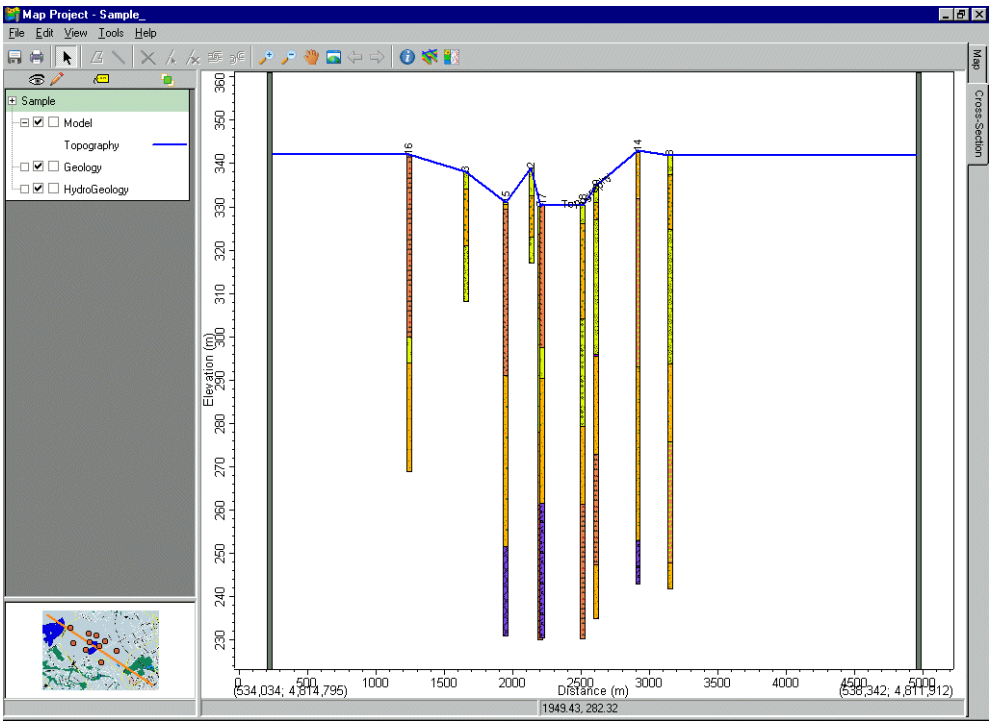
A confirmation dialog will appear.

- **[Yes]** to create the cross-section; the name assigned to the cross-section line will be used as the cross section name.

The cross-section editor opens the selected cross-section, and displays the stations and related information. The cross-section shows projections of the borehole's lithologic columns on the cross-section plane. By default, the top of model layer 1, (ground surface topography), will be drawn in for you.

The Cross section window should be similar to the one shown below:

NOTE: Yours may be slightly different depending on the location of the cross section line, and the stations which were selected along the line.



In the Cross Section editor, locations for layers must be interpreted, and drawn manually using lines or polygons; layer types may be Geological, Hydrogeological, or Model. The process of drawing layers is described in the next section.

For more details on some of the other features of the Map Manager, please see Chapter 8.

2.6 Interpreting and Viewing Cross-Sections

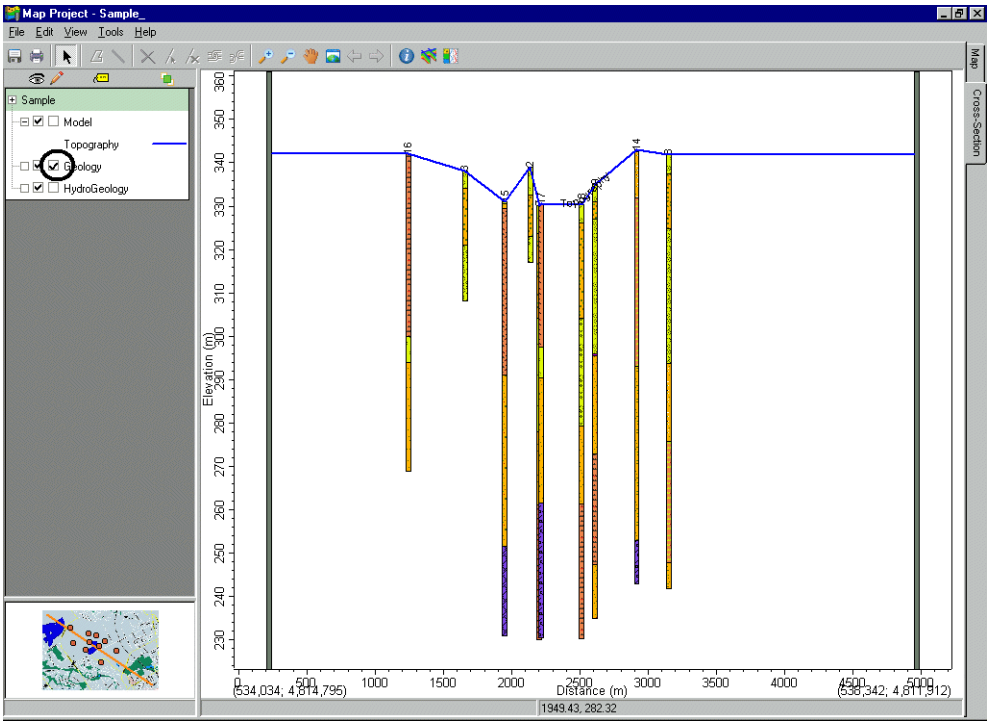
2.6.1 Drawing Geologic Cross-Sectional Layers

Once the desired stations have been loaded into the Cross Section Editor, the layer locations must be interpreted. To draw Geologic layers, the polygon draw tool must be used, and the polygon must be digitized manually using the mouse.

To draw a geological cross-section layer, follow the directions below:

☞ Click once in the box beside **Geology** from the Layer Manager panel, to activate this layer, and make it editable. You should have two check

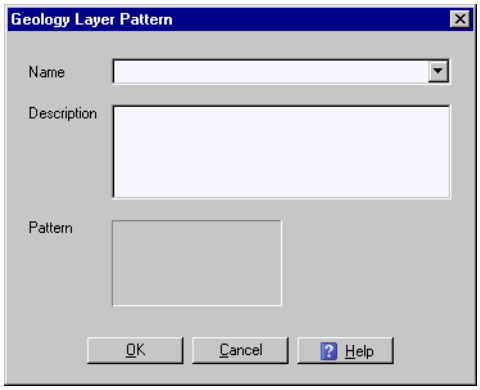
marks beside Geology, as shown in the image below; the first check mark indicates the layer is visible; the second check mark indicates the layer is editable (in edit mode).



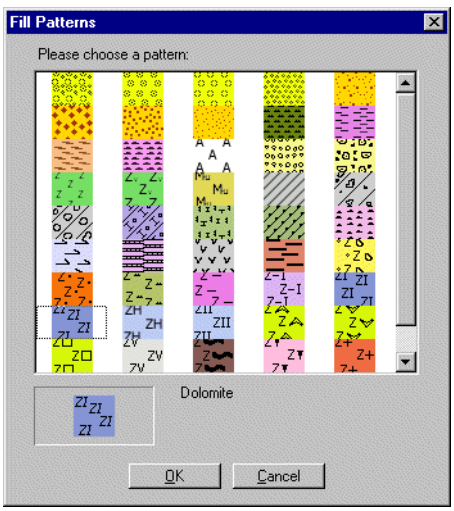
- ☞ Choose the (Polygon) button from the toolbar
- ☞ Place the mouse cursor near the top left corner of the map, near 340 m on the y-axis.
- ☞ Click once on the left mouse button to add a vertex and start digitizing the polygon in the desired direction;
- ☞ Add more vertices by clicking on the left mouse button at desired locations. Move the mouse cursor to an interval on a desired station; the mouse cursor will snap the vertex of the polygon to the nearest station interval. A vertex can also be added anywhere on the cross-section by clicking on the left mouse button.

HINT: When drawing interpretation polygons, use the soil patterns displayed in the boreholes as a guideline for the layer location; however, since it is a interpretation, it does not need to exactly match up with the interval locations.

☞☞ Double click anywhere on the cross-section using the left mouse button to close the polygon; the Geology Layer Pattern window will appear:



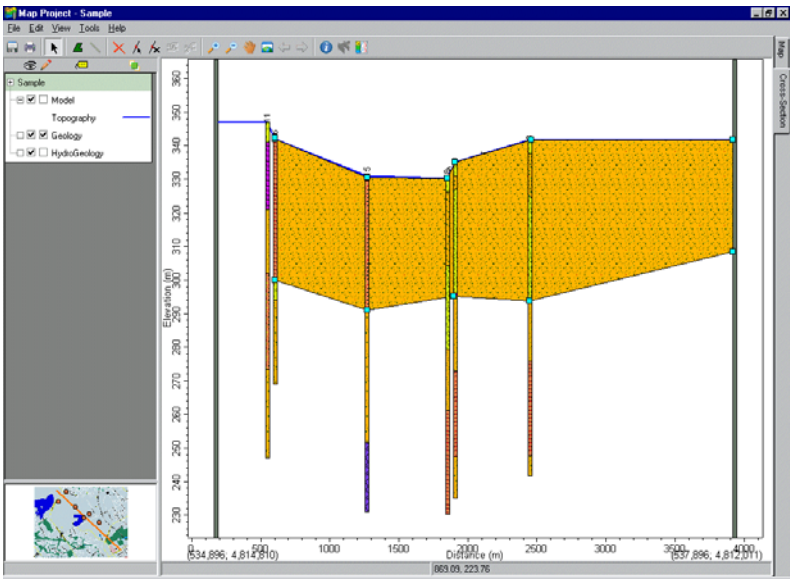
In the dialog that appears, enter a **Name** for the layer, a brief **Description**, and select a soil **Pattern**. If the geologic layer you have just digitized in the current cross-section has already been created, you may select it from the combo box, instead of typing a new name. Click on the blank area beside **Pattern** to load the pattern options, as shown in the following figure:



Select a pattern, (sand is located in the top-right corner of this dialog),

- ☞ **[OK]**
- ☞ **[OK]** once more

The polygon will be filled with this pattern; an example is shown below.



Repeat the same sequence of operations for other layers within the active cross-section. The result will be a layered structure of the geological domain. The cross-section may contain some gaps where polygons do not completely touch adjacent polygons; this can be easily fixed by selecting a vertex on a polygon, and using the pointer tool to re-position the vertex. Alternately, gaps between polygons can be filled by using the **Link Vertex** option. These options are explained in Chapter 9.

Once a layer is created in one cross-section, it will be available for selection in all other cross-sections that you create for your project. Altering the properties of a given layer will be reflected in all cross-sections.

Once the desired view has been obtained, the cross section may saved. To do so,

☞ **File > Save** from the main menu, or click the (Save) button from the toolbar.

Then, remove the editable status for the Geology interpretation. To do this,

☞ Edit check box beside **Geology** in the layer control.

For information on drawing model layers or hydrogeological interpretations, please see Chapter 9.

In the next section, you will view the cross section in 3D Explorer.

2.6.2 3D Visualization (Fence Diagrams)

The HydroGeo Analyst 3D Explorer allows for visualizing multiple cross sections in three-dimensions, and combining cross sections for creating fence diagrams. In addition, you may visualize transient contaminant plumes for one or more chemicals in your project.

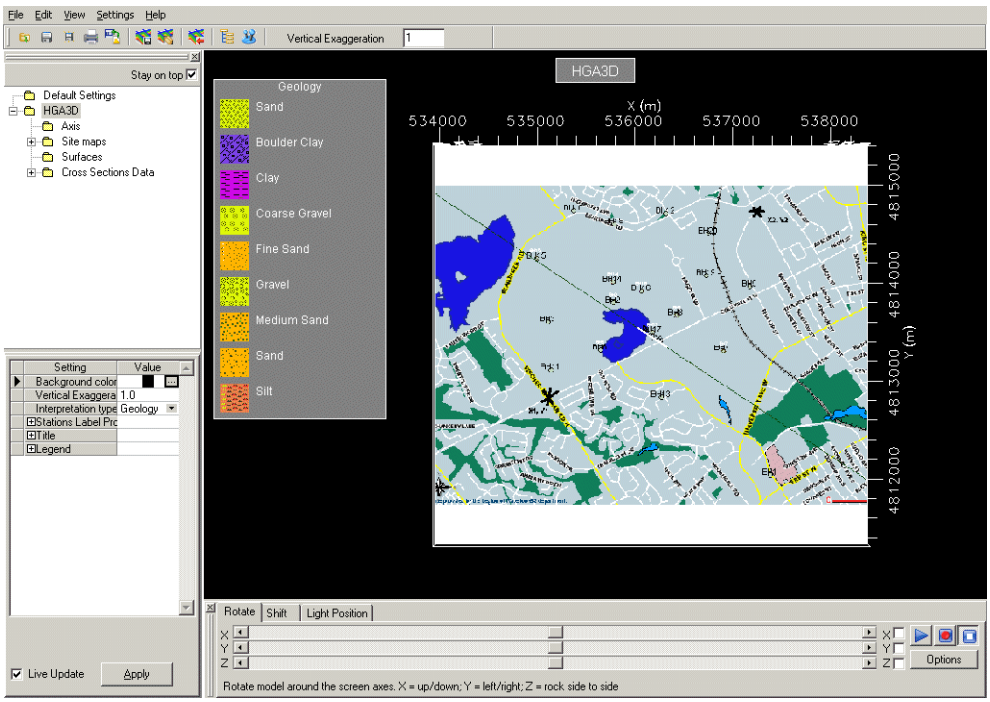
To load a cross section into 3D Explorer,

☞ **View > View 3D** from the main menu, or click on the (View 3D) button from the toolbar.

In this dialog you may select which cross-sections, surfaces, or 3D plumes should be added to the 3D project.

☞ **[OK]** to accept the default settings.

This will load the 3D Explorer window, as seen in the following figure.



The Geologic Interpretations will be displayed by default. To better visualize the fence diagram, make the following changes to the view and grid orientation:

At the top of the 3D window, locate the **Vertical Exaggeration** factor field.

type: 10 for the Vertical Exaggeration

☞ **<Enter>** on the keyboard.

Next, rotate the grid so that you can view the fence diagram from the side. To do so, locate the **Navigation Tools** at the bottom of the window (these tools contain 3 tabs that control the **Rotate**, **Shift** and **Light Position** options). By default, the **Rotate** tab will be selected, and will contain three slider bars, one for each of the X, Y, and Z axes.

☞ **X Slider bar** and slowly drag this to the left.

Watch the 3D grid rotate as you do this. Stop when you have reached a satisfactory side profile of the fence diagram.

Next,

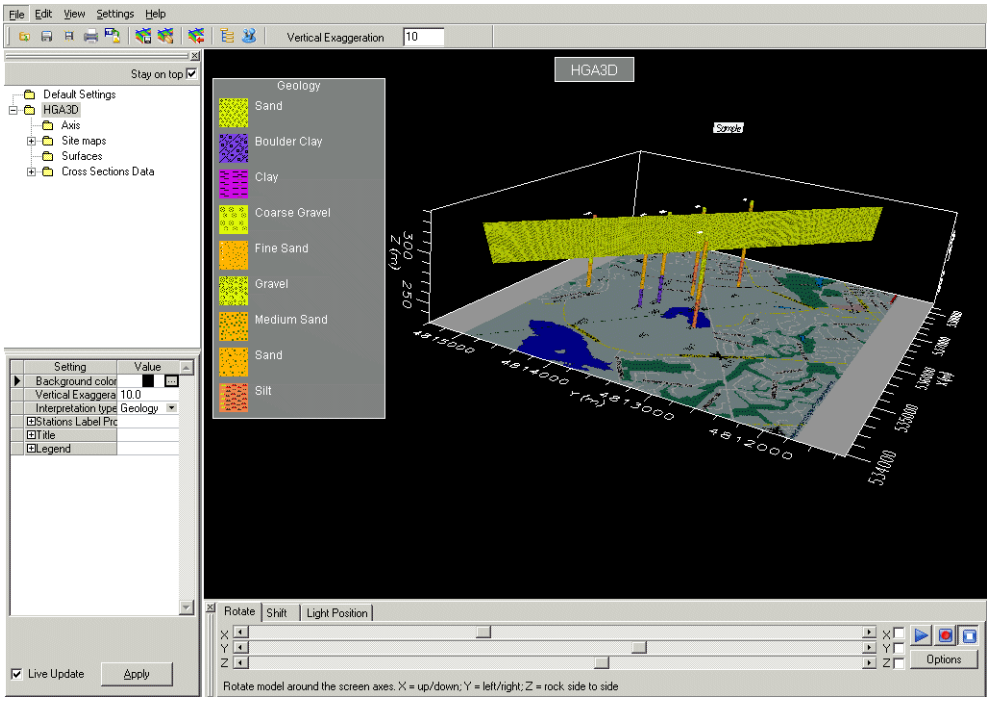
☞ **Y Slider bar** and slowly drag this to the right.

Watch the 3D grid rotate as you do this. Stop when you have reached a satisfactory side profile of the fence diagram.

Finally,

☞ **Z Slider bar** and slowly drag this to the right.

After rotating the grid, your 3D image should be similar to the one shown below.



The full capabilities of 3D Explorer are not discussed in this chapter. For details on how to use 3D Explorer, please refer to Chapter: 10 HydroGeo Analyst 3D-Explorer.

- **File > Save** from the main menu to save the 3D project

Once the desired view has been loaded, the 3D image may be loaded into the Report Editor. To do so,

- **File > Print** from the main menu, or click the (Print) button from the toolbar. This will load the Report Manager, where the 3D view may be customized, or printed as is.

In the next section, you will create a few sample reports. Before proceeding, close the 3D Explorer:

- **File > Exit** from the main menu

2.7 Preparing Reports

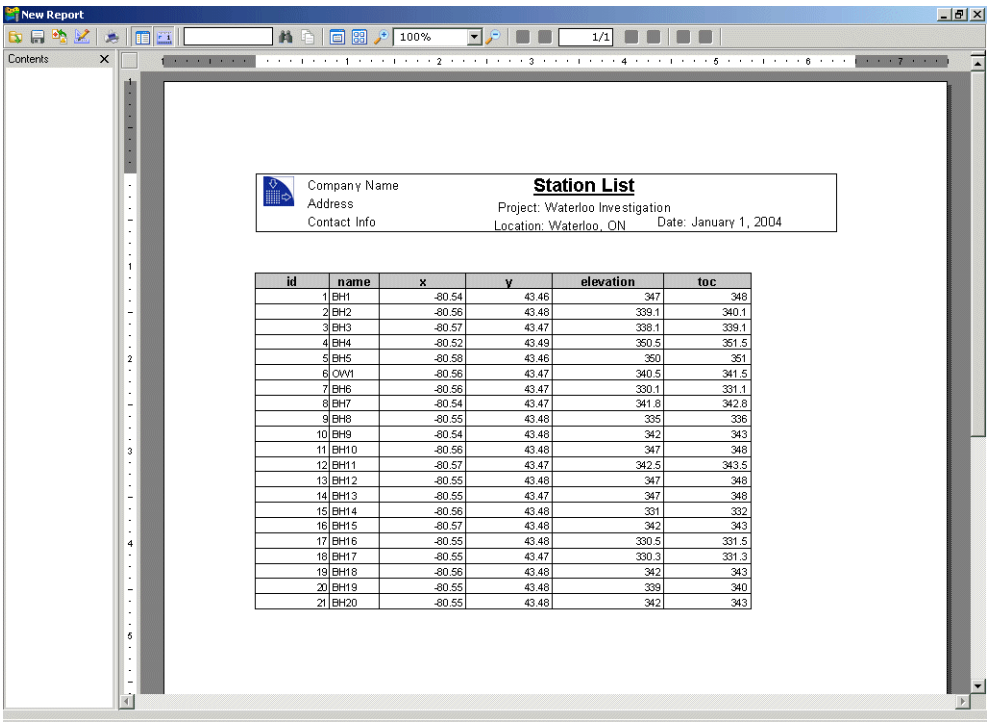
The Reporting component included with the HydroGeo Analyst package allows for creating reports containing any data from the database, in addition to charts, maps, cross-sections, and 3D views.

2.7.1 Creating Data Reports from Grids

Select any grid, then press the print button on the toolbar. If a template is available, there will be a prompt to select a template. For example, if you want to print the station list,

- **Station List** tab
- (Print) button from the toolbar. A print template may be selected, if desired.
- **[OK]**

This will load the Report Viewer. An example is shown below.



id	name	x	y	elevation	toc
1	BH1	-80.54	43.46	347	348
2	BH2	-80.56	43.48	339.1	340.1
3	BH3	-80.57	43.47	338.1	339.1
4	BH4	-80.52	43.49	350.5	351.5
5	BH5	-80.58	43.46	350	351
6	OW1	-80.56	43.47	340.5	341.5
7	BH6	-80.56	43.47	330.1	331.1
8	BH7	-80.54	43.47	341.8	342.8
9	BH8	-80.55	43.48	335	336
10	BH9	-80.54	43.48	342	343
11	BH10	-80.56	43.48	347	348
12	BH11	-80.57	43.47	342.5	343.5
13	BH12	-80.55	43.48	347	348
14	BH13	-80.55	43.47	347	348
15	BH14	-80.56	43.48	331	332
16	BH15	-80.57	43.48	342	343
17	BH16	-80.55	43.48	330.5	331.5
18	BH17	-80.55	43.47	330.3	331.3
19	BH18	-80.56	43.48	342	343
20	BH19	-80.55	43.48	339	340
21	BH20	-80.55	43.48	342	343

☞ (Print) button once again to print the contents as is, or view the Report Designer to change the report format.

Please see Chapter 11: The Report Editor, for more details on printing and modifying reports.

This concludes Chapter 2: Getting Started. Feel free to experiment with many of the features that HydroGeo Analyst has to offer, which have not been covered in this chapter.

To exit the program, return to the HydroGeo Analyst window, and

☞ **Project > Exit**

3

Using HydroGeo Analyst

The following topics will be discussed in this chapter:

HydroGeo Analyst: Fundamental Concepts:

- Introduction
- Station Types
- Stations Table
- Station Groups
- Data Categories
- Data Entry

HydroGeo Analyst Main Menu Bar:

- Project
- Edit
- View
- Record
- Settings
- Tools
- Help

Finally, a description of the major components which make up the HydroGeo Analyst package is provided. These components simplify the task of managing, analyzing, and visualizing the data stored in the database, and include:

- Template Manager
- List Editor
- Material Specifications Editor
- Project Manager
- Data Transfer System (*DTS)
- Query Builder
- Map Manager
- Cross-Section Editor
- 3D Explorer
- Report Editor
- Borehole Log Plot (BHLP) Designer

- Unit Converter

3.1 HydroGeo Analyst: Fundamental Concepts

3.1.1 Introduction

HydroGeo Analyst is designed to manage databases with any structure, and any level of referential integrity constraints. As such, a project database is not limited in the number of tables it may contain, nor in the relationship between the tables.

A HydroGeo Analyst database is designed to store any type of environmental data. Most environmental data is inherently spatial, as samples and observations are taken at specific locations in the map coordinate and elevation. In HydroGeo Analyst, these sampling sites are known as **Stations**.

Station Types

In HydroGeo Analyst, all data is saved and referenced to a **Station**. A **Station** is a unique real-world location at which data collection activities are performed. Depending on the scope, a project may contain single or multiple station types, each with its own attributes. Typical examples of stations are explained below.

Boreholes

A borehole is a hole drilled at a site for exploration of subsurface geologic structure, soil and rock parameters, and groundwater characteristics. Station attributes for a borehole include: Station ID, Site ID, coordinates, elevation, depth, date of drilling, driller name, method of drilling, number of layers, soil and rock classification used, types of sampling, split spoon soil samples, static GW level, etc.

Pumping Wells

A pumping well is installed in a borehole, and may be used for water supply, or aquifer test analysis. Station attributes for a pumping well include: Well ID, site ID, coordinates, elevation, depth, date of drilling, driller name, method of drilling, number of casing intervals, maximum casing diameter and type, minimum casing diameter and type, number of screened intervals, screen diameter and type, type of pump, average productivity, pumping rate, etc.

Observation/Monitoring Wells

An observation well may be used to monitor groundwater levels and groundwater chemistry. An observation well is installed in a borehole by casing the borehole, and developing the well. Station attributes for an observation well include: Well ID, site ID,

coordinates, elevation, well depth, screen locations, casing diameter and type, number of screened intervals, screen diameter and type, water level measurements, and groundwater chemistry analysis results.

Surface Water Observation Point

This station type may be a point on a river or a stream, equipped to take water samples and measure river discharge and water level. Station attributes include: Station ID, site ID, river ID, coordinates, elevation, type of observations, type of equipment, water chemistry, flow rates, etc.

Weather Station

This station may be an observation point equipped to measure weather characteristics. Station attributes include: Station ID, site ID, coordinates, elevation, construction date, type of measurements, observations start, observations end, temperatures, precipitation, solar radiation, air quality, etc.

Stations Table

The Stations Table stores all the station location information for all projects residing in the database. All additional tables you create in your database are directly or indirectly linked to the Stations Table.

The Station Table may contain an unlimited number of fields. Though, as a minimum, the Station Table must contain the following fields:

- Station ID (ID)
- Station Name (Name)
- Station Coordinate (X)
- Station Coordinate (Y)
- Station ground surface elevation (Elevation)

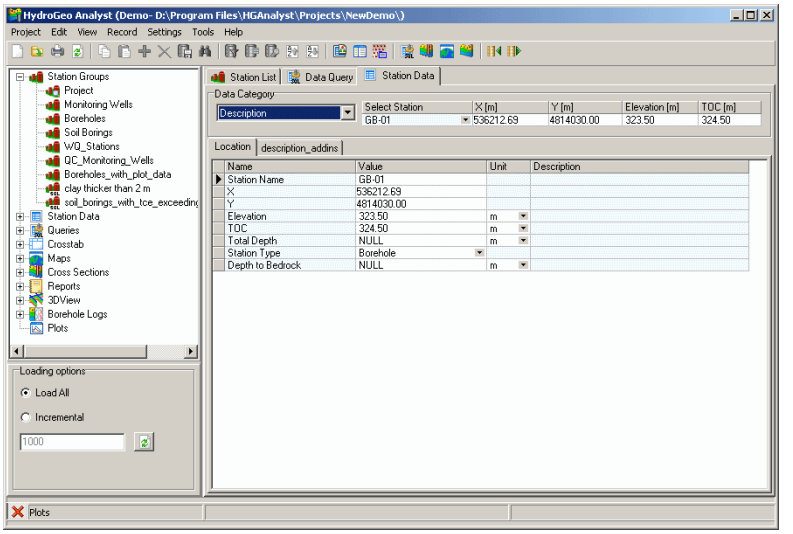
If plotting stations on a map or cross-section is desired, then the following fields are required:

- Station X co-ordinate
- Station Y co-ordinate
- Station ground surface elevation (Elevation)

Station coordinates are stored in the Stations Table in latitude-longitude format by default. However, each project may contain its own projection and coordinate system settings, so that station locations may be entered and displayed in an alternate format (e.g. UTM, State Planar, etc.). These options are available in the Template Editor.

Stations can be added, modified, or deleted through the **Station List** tab. The Station List tab displays a limited number of fields for viewing and editing; for a more detailed view of each station, the **Station Data** tab must be used; the information displayed in

the Stations Table can be found in the **Description** Data Category within this tab, in the Location table as shown below.



Existing station data from other databases or files can also be imported through the use of the Data Transfer System (DTS). The DTS supports importing from text files, spreadsheets (.XLS), and databases (e.g. MS Access Database).

One or more stations can be selected from the Stations list and grouped into logical groupings called **Station Groups**. This feature is explained in the following section.

Station Groups

Most operations in HydroGeo Analyst require the selection of one or more stations in the Station List tab. An example of such an operation is data entry. One or more stations for which you would like to add, view and/or modify data need to be selected so that the Station Data tab is accessible (activated).

The complete list of stations that comprise a project can be viewed in the Station List tab by selecting the **Project** item, under the **Station Group** node in the project tree. However, for some of the tasks commonly performed in HydroGeo Analyst, retrieving the complete list of stations in the project may not be necessary. Moreover, retrieving all the stations when only few of them are needed may be a time-consuming process especially for large databases containing hundreds or thousands of stations.

The solution is to create Station Groups. Grouping stations into their logical groups allows efficient management and quick retrieval of data stored in the database. For instance, all stations which contain groundwater chemistry sampling data can be grouped together under a group named as GW Sample Locations. Whenever these

stations need to be updated with a new groundwater sampling round, selecting the GW Sample Locations group displays only those stations that belong to this group.

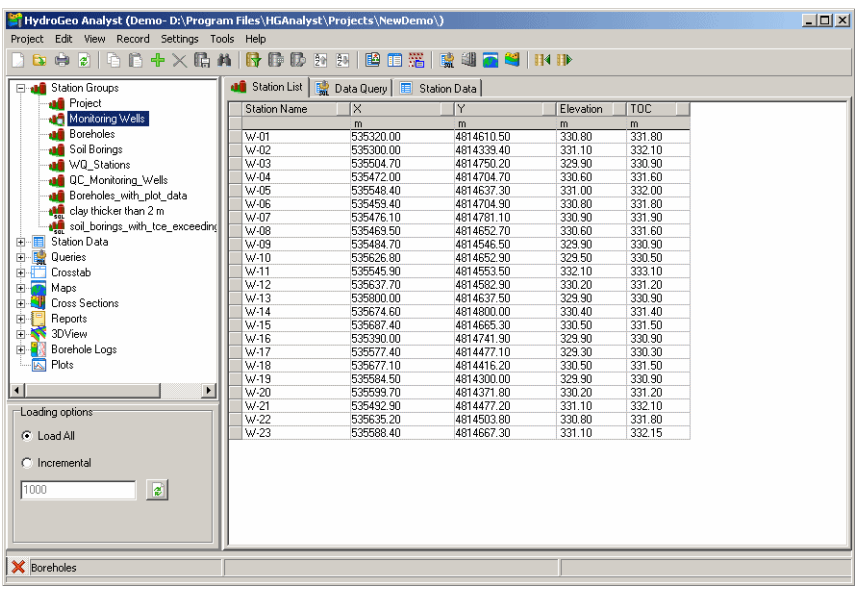
Station groups can be created based on any criteria. Common examples include:

- Locations of the stations (e.g. locations sorted by City, Project Sites, etc.)
- Station type (e.g. Monitoring Locations, Boreholes, etc.), or
- Purpose of Study (e.g. remediation, site monitoring)

There are two ways of creating Station Groups in HydroGeo Analyst:

- **Directly**: Select two or more stations directly in the Station List tab, *right-mouse* click, and select the **Add to Station Group** option from the pop up menu.
- **Indirectly**: Using the query builder, define a more advanced search criteria, and build a station group with those stations that satisfy the query criteria.

All station groups created for a project are listed in the **Project Browser** under the **Station Groups** node. Clicking on any of the sub-nodes corresponding to a station group will load the **Station List** tab, and display the appropriate stations belonging to that group. An example is shown below:



If desired, selected stations can be removed from a Station group or the Station group can be deleted as a whole.

Once the stations in a group are displayed, a number of operations can be applied based on the selection. For example, loading a station group and then selecting the **Display on Map** option from the **Record** menu, activates the Map Manager component and automatically creates a GIS layer containing all stations from this group.

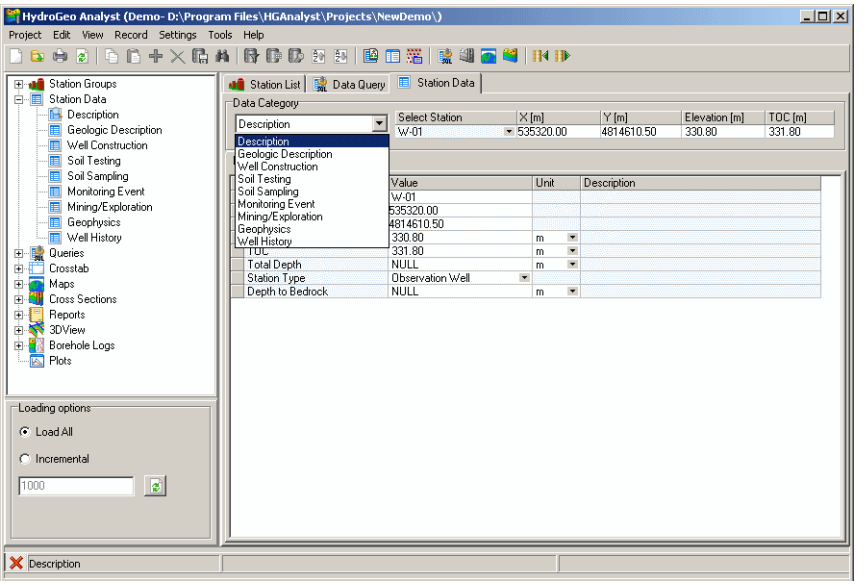
Data Categories

The tables in a HydroGeo Analyst database can be organized into a logical grouping by linking them to any one of the provided data categories. HydroGeo Analyst provides nine data categories, eight of which reflect the most common data categories found for environmental data. A ninth category, **User Defined Category**, can be renamed as appropriate and used accordingly.

The Station Data categories can be accessed from two locations:

- From the **Project Browser**, expand the **Station Data** node; OR
- From the main window, select the **Station Data** tab and expand the **Data Category** combo box (ensure that one or more stations are selected in the **Station List** tab)

Each of these options is displayed in the figure below:



After a Data Category has been selected, the appropriate tables and fields belonging to this category will be displayed in the **Station Data** tab.

The following is a complete list of the data categories provided in HydroGeo Analyst, along with some of the data entities that may be linked to each category:

- **Description** (e.g. station name, location, coordinates, elevation, site, etc.)
- **Geologic Description** (e.g. lithology, soil properties, hydrogeologic properties, etc.)
- **Well Construction** (e.g. drilling protocol, annular filling, monitoring points, casing materials, well dimensions, etc.)
- **Soil Testing** (e.g. SPT, pocket penetrometer, vane shear test, dynamic cone)

- **Soil Sampling** (e.g. Rock Coring, Soil Chemistry results, Soil Vapor, Moisture Content, Particle Size Distribution, Atterberg, Standard Proctor, Unconfined Compression, Direct Shear, Odometer (Consolidation)
- **Monitoring Events** (e.g. weather conditions, bailing, field properties, water quality, groundwater levels, groundwater chemistry)
- **Mining / Exploration** (e.g. Alteration, Mineralization, Structure, Samples, Down Hole Survey, Down Hole Geophysics)
- **Geophysics** (e.g. Conditions, Gamma, Neutron, 64 in E-log, 16 in E-log, Density)
- **Well History** (e.g. Pumping Rate, Pump, Screens, Top of Casing, status)
- **User Defined Category**

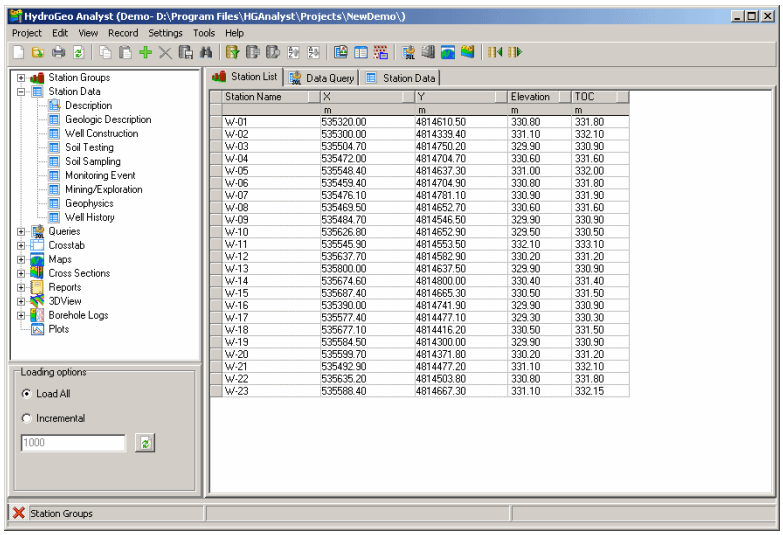
All of the above data categories may be renamed and used differently if desired. For example, the category named Geology could be renamed to Surface Water and tables such as Catchments, Surface Water Monitoring Locations, Rivers, etc. could be organized under it. Placing tables under any one of these categories does not have any effect on how the tables are stored in the database.

3.1.2 Data Entry

There are two locations in HydroGeo Analyst where data can be manually entered and/or edited: the **Station List** and the **Station Data** tabs. If the source data is available in a text file, spreadsheet (.XLS), or database, the data may be imported using the Data Transfer System (DTS).

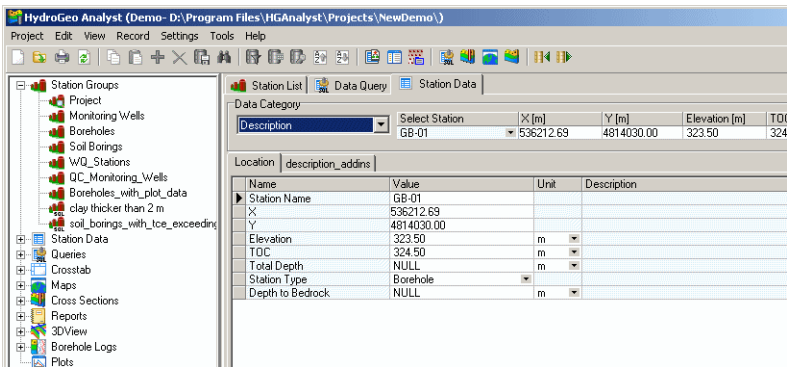
Station List Tab

The Station List tab provides an overview of the available stations in the selected Station Group. As such, only a few basic Station attributes (name, X-coordinate, Y-coordinate, Elevation) are displayed in this tab. These fields may be modified for a selected station; or a new station may be created here, and the values for these fields may be defined. The Station List tab may be used to quickly enter numerous stations, and define the basic attributes for each station.



Station Data Tab

For a more detailed view of a single Station's attributes, the Station Data tab should be selected, and an appropriate Data category chosen. The Station Data tab provides access to all data related to a single station. Once a Station is added to the project, detailed information on the station can be inserted, edited, or deleted through the Station Data tab.



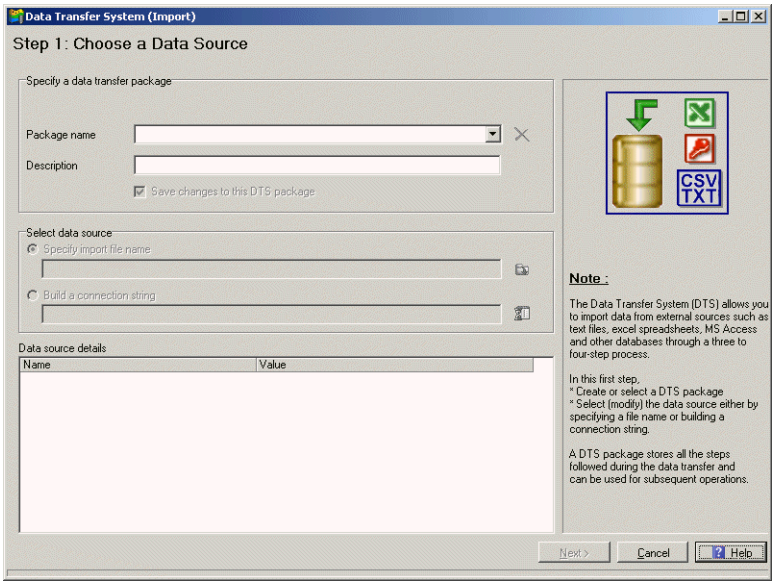
Data Transfer System (DTS)

If the project database is going to store numerous stations, it may be more efficient to import the data using the Data Transfer System (DTS). The DTS allows for importing data from the following source types:

- Text: (.CSV)

- Excel 97-2000 Spreadsheet (.XLS), or
- Any OLE-DB compliant database, such as MS Access Database (.MDB), SQL Server, etc.

The DTS can be loaded by selecting **Import / Data** from **Project** menu; the first DTS window is shown below:


Data Transfer System (Import)
Step 1: Choose a Data Source
Specify a data transfer package
Package name
Description
Save changes to this DTS package
Select data source
Specify import file name
Build a connection string
Data source details
Name
Value
CSV
TXT
Note :
The Data Transfer System (DTS) allows you to import data from external sources such as text files, excel spreadsheets, MS Access and other databases through a three to four-step process.
In this first step,
* Create or select a DTS package
* Select (modify) the data source either by specifying a file name or building a connection string.
A DTS package stores all the steps followed during the data transfer and can be used for subsequent operations.
Next >
Cancel
Help

The DTS also allows exporting data from a project to one of the following formats:

- Text files (.CSV)
- Excel 97-2000 Spreadsheet (.XLS), or
- Other databases

For more details on how to import/export data using the DTS, please refer to Chapter 6: The Data Transfer System.

3.2 HydroGeo Analyst Main Menu Bar

The HydroGeo Analyst menu items have been specifically designed for optimal flexibility and ease of use. The items in the menu bar are context sensitive; this means that one or more menu items may be greyed out if a specific feature is not applicable for a particular view. The top menu allows access to all of the functionality of the project browser (tree view) and all of the tabs.

The following menu items are available in HydroGeo Analyst:

- Project
- Edit
- View
- Record
- Settings
- Tools
- Help

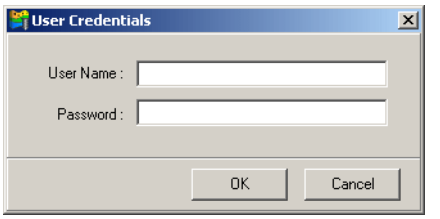
The following sections describe the items which appear in the main menu.

3.2.1 Project

New

Selecting the New menu item will launch the Project Manager with the option to create a new project. The Project Manager allows the user to select a server for the database, select or create a database for the new project, provide project related information (name, location, soil classification settings, etc.), and select a database structure if a new database is to be created. The (New) button in the toolbar performs the same function.

When creating a new project, there will be a prompt to enter the User name and password, in a dialog as shown in the example below:



You must enter a valid user name and password, for a user that has privileges for creating new projects. HGA will then check these credentials in the security document, to confirm that this user has these privileges. For more details on assigning user access controls, please see Chapter 4: Application Level Objects.

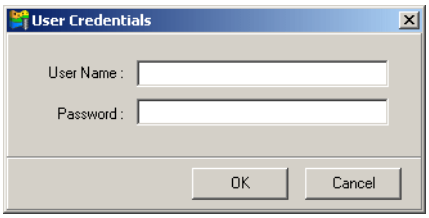
The process of creating a new project is further explained in Chapter 4: Using the Project Manager.

Open

The Open menu item is used to open existing HydroGeo Analyst projects. Only projects with the extension **.VBH** may be opened in HydroGeo Analyst. The .VBH file contains basic information for the project, including a connection string to the

HydroGeo Analyst database. The (Open) button in the toolbar performs the same function.

When opening a project, there will be a prompt to enter the User name and password, in a dialog as shown in the example below:



The default **User Name** is Admin, with no password. Enter the desired password, then click **[OK]** to continue.

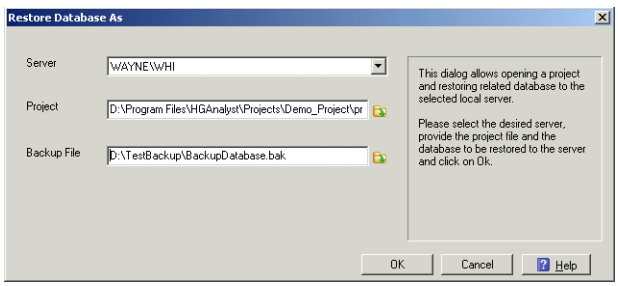
NOTE: Only one user may access and modify a HydroGeo analyst project at a time.

Open from Backup

Use this option to open a back up copy of the HydroGeo analyst project and database. This is useful if a remote client or colleague needs to open your HydroGeo Analyst project, and SQL Server database.

A back up of the SQL Server database can be made using the BackUp Database option (available in the Tools menu), explained later in this chapter.

A copy of the HGA project can be made by simply copying the project folder, and its contents, using Windows explorer.


Restore Database As
Server
WAYNE\WHI
Project
D:\Program Files\HGAnalyst\Projects\Demo_Project\pr
Backup File
D:\TestBackup\BackupDatabase.bak
This dialog allows opening a project and restoring related database to the selected local server.
Please select the desired server, provide the project file and the database to be restored to the server and click on Ok.
OK
Cancel
Help

In the Backup database dialog, specify the **Server**. The Server can be the WHI instance or SQL Server, provided it is on the local machine. Specify the **Project** to open (.VBH file) and specify the Database **BackUp File** (.BAK file).

NOTE: The user must have permissions to the “Manage Databases” and “Create Projects” objects in the ALSD, in order to use this option.

NOTE: If you are using SQL Server 2005 Express, you cannot open a backup database created by Microsoft SQL Server Desktop Engine 2000 (MSDE).

Close

Close the project which is currently open.

Re-Open

This menu item provides a list of projects that have been recently opened. The most recent project will appear at the top. Simply select the desired project, and it will be loaded into HydroGeo Analyst.

Import

Use the Import option to import data or reports into the project database; data may be imported from source files using the Data Transfer System package.

Data (Using DTS)

This option allows data to be imported into the HydroGeo Analyst project database, using the Data Transfer System (DTS). Data may be imported from the following sources:

- Text: (*.CSV, *.TXT, *.ASC, *.TAB)
- MS Excel 97-2000 Spreadsheet (*.XLS), or
- Any OLE-DB compliant database such as a MS Access Database (*.MDB)

For more details on how to import data using the DTS, please refer to Chapter 6: The Data Transfer System.

Station Data

This option allows for importing data from an LAS (Log ASCII Standard) file, a standard format introduced by the Canadian Well Logging Society in 1989. The LAS file contains two types of sections:

- Well Information Section: data related to the station (location, driller, etc.)
- Parameter/Curve Information Sections: descriptive and/or measured data for one or more downhole parameters.

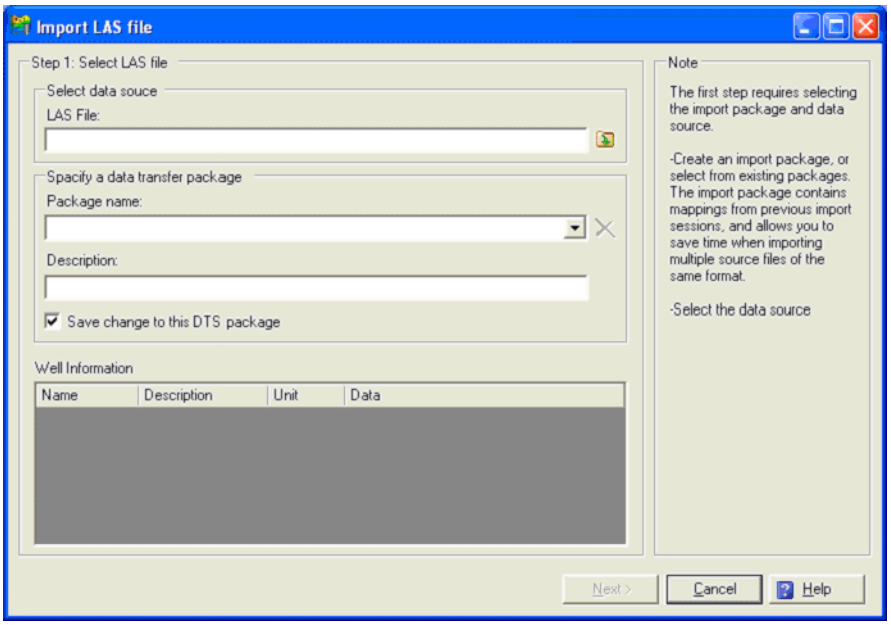
When importing the LAS file in HGA, the following options are available:

- Import the Well Sections and Parameter/Curve sections; use this option if you

want to import a new station, and one or more measured parameters for this station. A new station will be added to the HGA database, using station details (name, co-ordinates, etc.) in the LAS file. If the station already exists in HGA, you will be prompted to overwrite the details, using those in the LAS source. In addition, data from one or more parameters (Parameter Sections) may be imported to one or more tables in your database.

- Import only Parameter sections; use this option if this station already exists in your HGA project. HGA will read the station name in the LAS file, and attempt to find an appropriate match in the current HGA project.

When you select this option, the following dialog will appear:


Import LAS file
Step 1: Select LAS file
Select data souce
LAS File:
Spacify a data transfer package
Package name:
Description:
Save change to this DTS package
Well Information
Name
Description
Unit
Data
Note
The first step requires selecting the import package and data source.
-Create an import package, or select from existing packages. The import package contains mappings from previous import sessions, and allows you to save time when importing multiple source files of the same format.
-Select the data source
Next >
Cancel
Help

The first step requires selecting the data transfer package and data source.

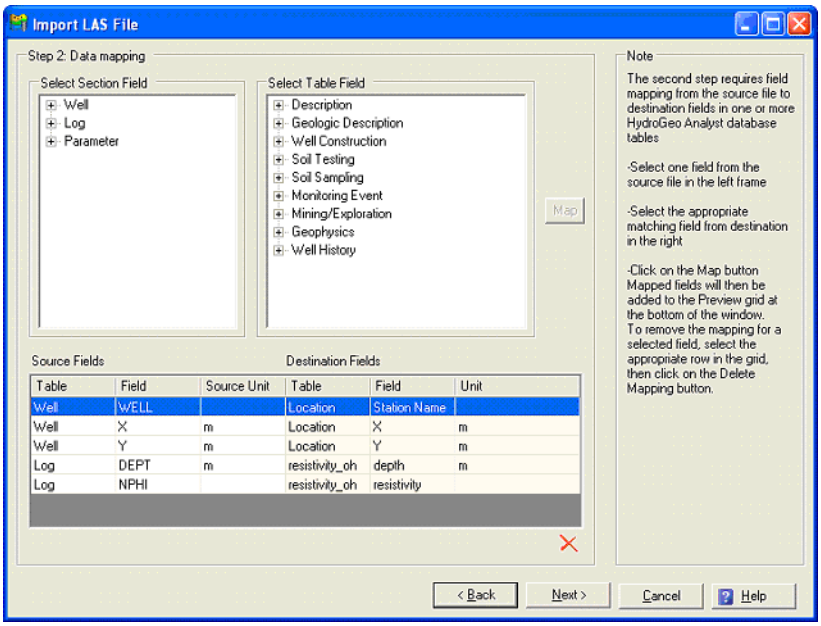
A Data Transfer Package (DTP) is designed to store all settings of desired import operations that may be repeated from time to time. For example, importing several LAS files containing the same measured parameters. The DTP contains information about the data source, the selected destination table(s), matching between source and destination tables and fields, source units, and a number of other settings. You may create an import package, or select from existing packages.

All Data Transfer Packages (if any) are listed for selection at the beginning of all data transfer operations. If an existing package is selected, the import routine loads all information stored in the package. The information can then be reviewed and updated as desired before as you move through the data transfer operation.

After selecting the package, select the **Data Source**; please note the following limitations:

- HGA currently supports LAS v.2.0.
- Third dimensional data array handling is currently not supported
- Multiple log runs is currently not supported

When you are finished, click the **[Next>]** button in the lower right corner to proceed to the next step. The next step is Data Mapping.


Import LAS File
Step 2: Data mapping
Select Section Field
Well
Log
Parameter
Select Table Field
Description
Geologic Description
Well Construction
Soil Testing
Soil Sampling
Monitoring Event
Mining/Exploration
Geophysics
Well History
Map
Note
The second step requires field mapping from the source file to destination fields in one or more HydroGeo Analyst database tables
-Select one field from the source file in the left frame
-Select the appropriate matching field from destination in the right
-Click on the Map button Mapped fields will then be added to the Preview grid at the bottom of the window. To remove the mapping for a selected field, select the appropriate row in the grid, then click on the Delete Mapping button.
Source Fields
Destination Fields
Table Field Source Unit Table Field Unit
Well WELL Location Station Name
Well X m Location X m
Well Y m Location Y m
Log DEPT m resistivity_oh depth m
Log NPHI resistivity_oh resistivity
< Back
Next >
Cancel
Help

The next step in the data transfer operation is to match a source table with a destination table.

You may map the entire LAS file (including the Well Section), or just downhole parameters; if you do not include the well section, you must have the appropriate station already created in your HGA project. HGA will read the station name in the LAS file, and attempt to find an appropriate match in the current HGA project. If one is found, you may proceed. Otherwise, you must include the well section, or terminate the import routine and return to HGA and create the appropriate station (using the same station name as found in the LAS source).

If duplicate station names are found in the HGA database, there will be a prompt to select the appropriate station.

The Data Mapping window is divided into two frames:

- The **Source** well section, found on left side of the window; and

- The **Destination** HGA tables and fields, on the right side of the window

The **Source** frame (which contains the data to be imported) can be expanded on the left side of the window. If the field names in the source are identical to those in the destination, then the fields will be matched automatically. For all others, you must map the fields using the procedure below.

The **Destination** frame contains the HGA database schema: all tables and fields under their appropriate data categories. From this frame, select a **Category**, then a **Table** from this category, and a list of fields will be displayed in the grid on the right side of the window.

Mapping

Mapping fields from the LAS file to the HGA database is described below:

- ☞ Select one field from the source file in the left frame
- ☞ Select the appropriate matching field from destination in the right (by expanding the appropriate data category and table)
- ☞ Click on the Map button

Mapped fields will then be added to the **Preview** grid at the bottom of the window. Repeat these steps for additional fields.

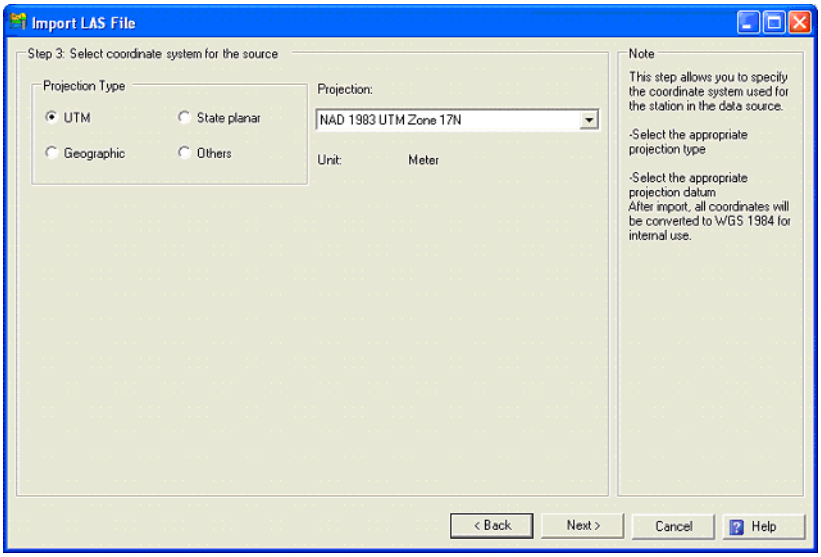
To remove the mapping for a selected field,

- ☞ Select the appropriate row in the **Preview** grid
- ☞ Click on the Delete Mapping button

Units

Due to the flexible nature of the LAS file, there may exist one or more parameters with units that are not supported in HGA; as such, unit conversion will not be possible during the import. Where the unit categories and units exist, HGA will attempt to do unit conversion, and import the data. If the destination field does not support the selected source units, there will be no conversion, and the data will not be imported. For this reason, it may be necessary to modify the field settings for your database schema, before proceeding with the import. For more details, see Chapter 5: Modifying Fields and View Settings.

When you are finished, click the **[Next>]** button in the lower right corner to proceed to the next step.



If the data to be imported contains the Well Section, then some additional information may be required in order to allow proper data transfer. The **Station Related Settings** window (as shown below) will only be displayed if data is imported to the **Stations** table.

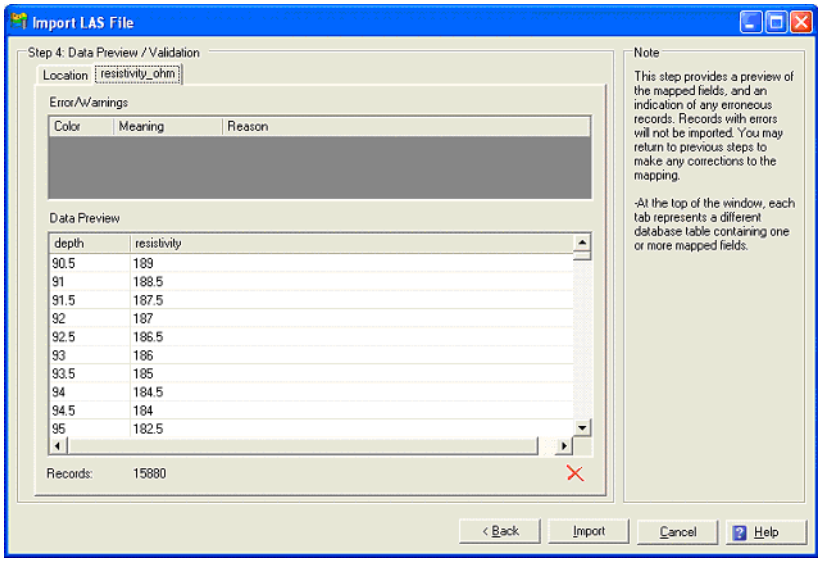
Projection Settings

Define the coordinate system, the projection system, and the units for the stations in the source file. Following successful import, the new stations will be converted to the projection system and units defined in the HydroGeo Analyst project. A detailed description of the coordinate and projection systems available in HydroGeo Analyst is provided in Chapter 4. See “Step 3: Set Project Properties and Location” on page 175.

NOTE: It is important to know and select the correct project system during the import, to prevent erroneous station co-ordinates.

The LAS file allows to specify a place holder for NULL values (common examples are -999.0000). Wherever this value is detected in the source, HGA will insert NULL in the destination, according to the field setting specified in the Template Manager.

When you are finished, click the **[Next>]** button in the lower right corner to proceed to the next step.



The last step in the import involves previewing the data to be imported, and taking appropriate actions with regards to erroneous data. The **Data Validation** window (as shown below) displays all data ready to be imported. Errors or warnings, if any, will be listed along with the data. Records with errors will not be imported. You may return to previous steps to make any corrections to the mapping.

The data is checked against the following conditions:

- Proper Station Locations
- Data type compatibility

NOTE: All coordinates in the database are **stored** in latitude-longitude format (WGS 1984) for internal use, regardless of the projection system in the source file and project. The **Preview** in this window displays the converted station co-ordinates. However the station co-ordinates may be **displayed** in HydroGeo Analyst in any projection system desired.

At the top of the window, each tab represents a different database table containing one or more mapped fields.

Accepting or Rejecting Records

Any of the records in the preview window may be accepted or rejected.

To accept the selected records, click on the (Accept) button.

To reject the selected records, click on the (Reject) button.

Finalizing the Import

Once you have removed or verified the errors,

☞ **[Import]** button to import the data to the project.

After successfully importing the data, a confirmation window will appear, similar to the one shown below.

To close the import routine, and return to HGA Analyst,

☞ **[OK]** button in the confirmation dialog, then

☞ **[Close]** button at the bottom of the window

MON Data

This option allows for importing data from a MON file, a format generated from datalogger monitoring software such as PocketDiver, LoggerDataManager, DiverOffice and e-SENSE. MON files consist of three sections: Logger Settings, Data Series and Data.

The *Logger Settings* section contains the current settings of the logger including the location, sample method, sample rate, serial number and available channels.

The *Data Series* section contains information on when field measurements were taken.

The *Data* section contains all the measurements for each channel, ordered by date and time.

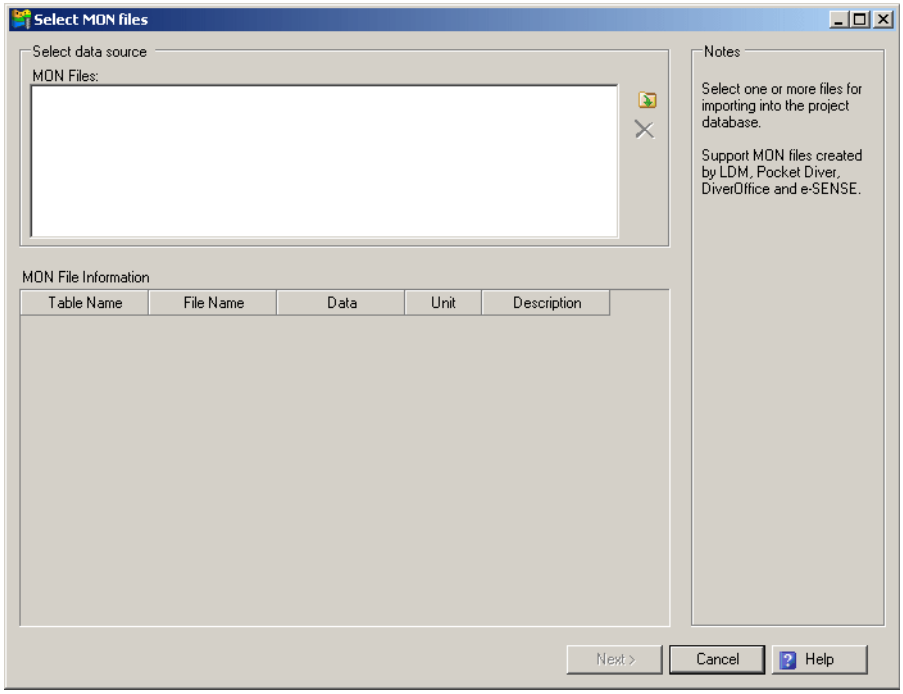
To import MON file data into your HGA database, follow the steps below:

- **STEP 1:** Select MON Data Files
- **STEP 2:** Map Data Fields
- **STEP 3:** Import Data into the Database

Please note that the MON data import procedure can accommodate multiple MON files, simultaneously. However, for demonstration purposes, only one MON file will be used in the following guide.

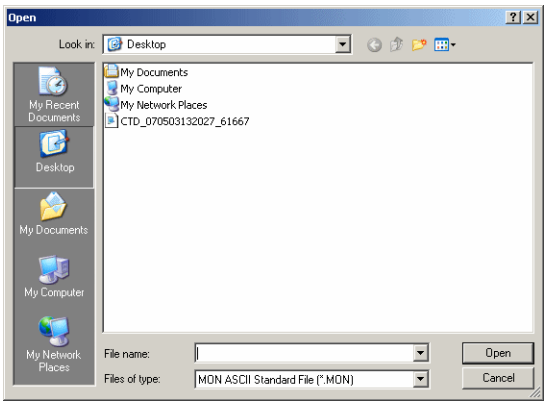
Also, before you import data from MON files into HGA, the water level values need to be calculated with respect to the top of the well casing. This can be done through SWS datalogger software (DiverOffice, Data Logger Manager) by performing barometric compensation on the MON data, using the “Top of Casing” method.

Step 1: Select MON Data Files

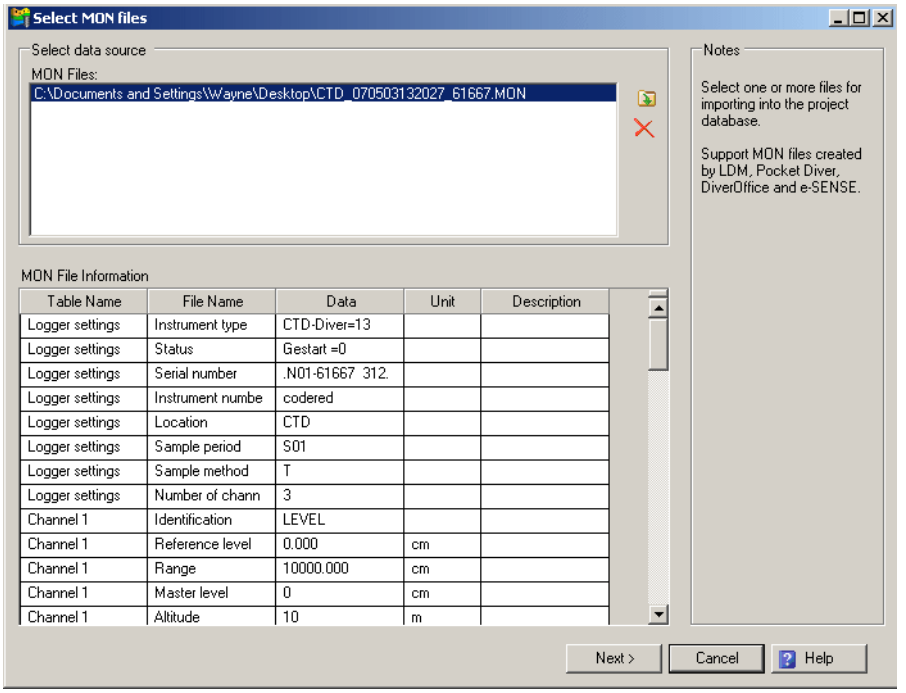


The first step requires specifying a MON data source.

- ☞ Click the **Open Folder** button
- ☞ Locate and select a MON file(s), and click **[Open]**.



The selected MON file(s) will now appear under the **Select data source** frame (shown below).

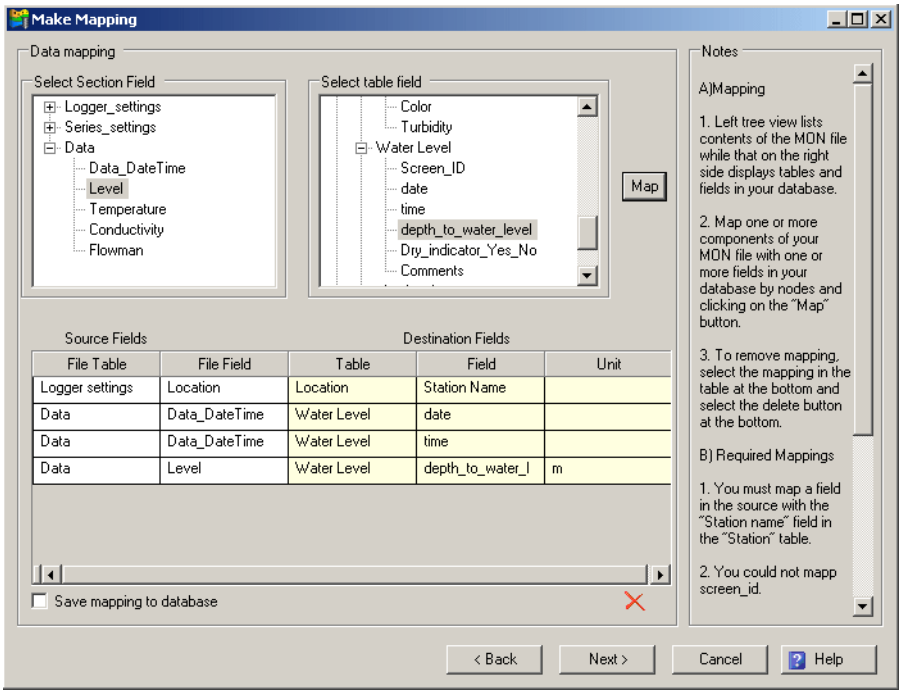

Select MON files
Select data source
MON Files:
C:\Documents and Settings\Wayne\Desktop\CTD_070503132027_61667.MON
Notes
Select one or more files for importing into the project database.
Support MON files created by LDM, Pocket Diver, DiverOffice and e-SENSE.
MON File Information
Table Name | File Name | Data | Unit | Description
Logger settings | Instrument type | CTD-Diver=13
Logger settings | Status | Gestart =0
Logger settings | Serial number | .N01-61667 312.
Logger settings | Instrument numbe | codered
Logger settings | Location | CTD
Logger settings | Sample period | S01
Logger settings | Sample method | T
Logger settings | Number of chann | 3
Channel 1 | Identification | LEVEL
Channel 1 | Reference level | 0.000 | cm
Channel 1 | Range | 10000.000 | cm
Channel 1 | Master level | 0 | cm
Channel 1 | Altitude | 10 | m
Next >
Cancel
Help

Below the *Select data source* frame is the **MON file Information** table. This table contains the datalogger information of the selected MON file (“MON Data” on page 116).

To remove a MON file from the list, select the file and click the **Delete** button .

Click **[Next>]** to proceed to **Step 2: Data Mapping.**

Step 2: Data Mapping



The next step in the MON data import operation is to map the MON file fields (source) with the appropriate HGA fields (destination). To map a source field with a destination field,

- ☞ Select a source field from the MON file in the *Select Section Field* frame
- ☞ Select the matching destination field from the *Select Table Field* frame
- ☞ Click the **Map** button.

Rules for Mapping

- The **Station Name** field of the **Location** table must be mapped.
- All destination tables and fields must already exist in the HGA database.
- All mapped channel tables (e.g. Level, Temperature, Conductivity, Oxygen) in the database must include a Screen ID.
- All mapped tables in the database must have primary key(s) mapped.
- Data type of mapped fields must be compatible.

The mapped fields will now display in the table at the bottom of the **Make Mapping** dialog. Repeat this process for additional fields.

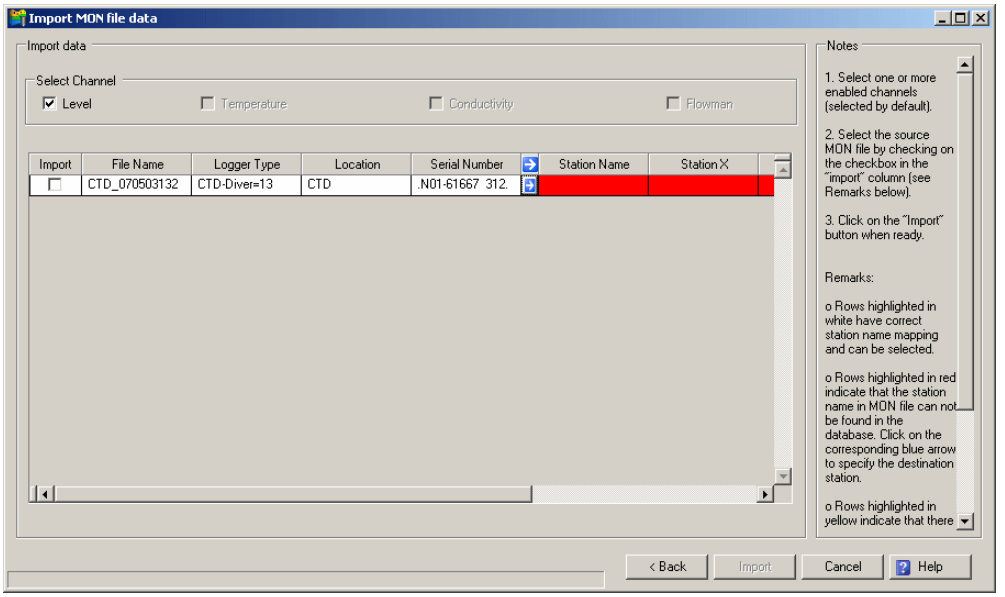
To remove mapping,

- ☞ Select the appropriate row in the preview grid
- ☞ Click the **Delete** button .

Select the **Save mapping to database** checkbox to retain the mapping for future MON file import operations.

Click **[Next>]** to proceed to **Step 3: Importing Data into the Database.**

Step 3: Importing Data into the Database


Import MON file data
Import data
Select Channel
Level
Temperature
Conductivity
Flowman
Import
File Name
Logger Type
Location
Serial Number
Station Name
Station X
CTD_070503132
CTD-Diver=13
CTD
.N01-61667_312.
Notes
1. Select one or more enabled channels (selected by default).
2. Select the source MON file by checking on the checkbox in the "import" column (see Remarks below).
3. Click on the "Import" button when ready.
Remarks:
o Rows highlighted in white have correct station name mapping and can be selected.
o Rows highlighted in red indicate that the station name in MON file can not be found in the database. Click on the corresponding blue arrow to specify the destination station.
o Rows highlighted in yellow indicate that there
< Back
Import
Cancel
Help

From the **Select Channel** frame, select a parameter (i.e. Level, Temperature, Conductivity, Flowman). **NOTE:** A selection is not necessary if all the channels are inactive (grey).

HGA will read the station name in each MON file, and attempt to find an appropriate match in the current HGA project. If one is found, you may proceed. Otherwise, the field will display a color and you must specify the appropriate destination station name.

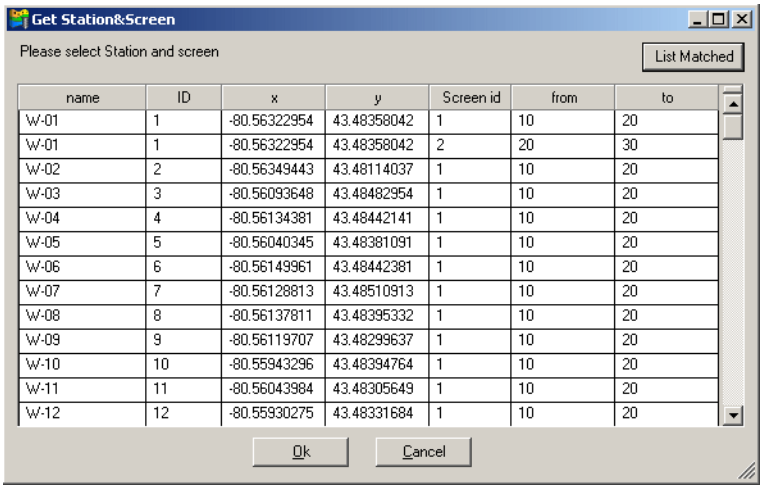
The color displayed in the information table represents the number of station names that can be matched with the location information in the MON file.

White: indicates that a single station name has been found.

Red: indicates that a matching station name could not be found.

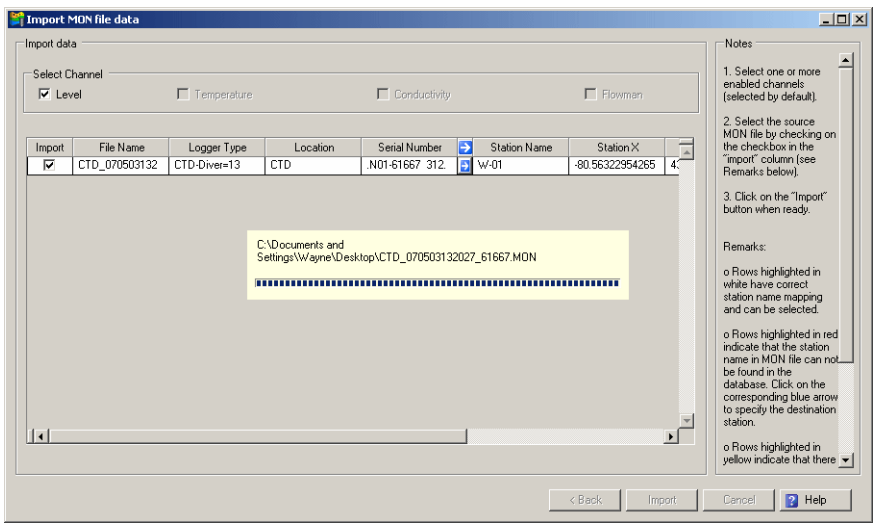
Yellow: indicates that two or more matching station names exist in the database.

If a row is either red or yellow, click the button and manually specify a destination station name from the HGA database.

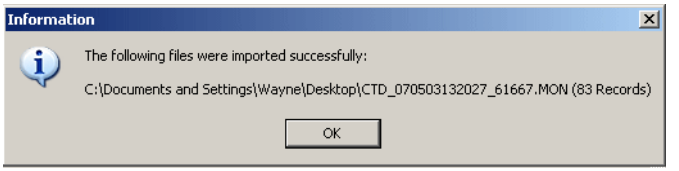


From the **Get Station&Screen dialog**, select a destination station and a screen id. Click the **List Matched** button to open the List Matched dialog. This dialog will display all the possible station and screen_id combinations that match the MON data. After selecting, click **[Ok]**.

Click the **[Import]** button to finalize the data import.


Import MON file data
Import data
Select Channel
Level
Temperature
Conductivity
Flowman
Import File Name Logger Type Location Serial Number Station Name Station X
CTD_070503132 CTD-Diver=13 CTD N01-61667_312 W-01 -80.56322954265
C:\Documents and Settings\Wayne\Desktop\CTD_070503132027_61667.MON
Notes
1. Select one or more enabled channels (selected by default).
2. Select the source MON file by checking on the checkbox in the "import" column (see Remarks below).
3. Click on the "Import" button when ready.
Remarks:
o Rows highlighted in white have correct station name mapping and can be selected.
o Rows highlighted in red indicate that the station name in MON file can not be found in the database. Click on the corresponding blue arrow to specify the destination station.
o Rows highlighted in yellow indicate that there
< Back
Import
Cancel
Help

Upon clicking **[Import]**, a progress bar will display (shown above). If the import is successful, a confirmation message will appear, similar to the one shown below.



Export

Use the Export option to export data from the HG Analyst project; data may be exported to external files in various formats, using the DTS.

Export Data

This menu item will load the DTS with an option to export data from any grid, to one of the following file formats:

- Text: (*.CSV, *.TXT, *.ASC, *.TAB)
- Excel 97-2000 Spreadsheet (*.XLS), or
- Any OLE-DB compliant database such as MS Access Database (*.MDB)

For more details on this utility, please see the DTS section in Chapter 6: The Data Transfer System.

Export Grid

All HydroGeo Analyst data that can be displayed in any of the grids can be exported to a number of external destinations. The data could be a station list from any station group, a result of a query execution, or any data from the data entry tabs.

HydroGeo Analyst allows exporting data displayed in grids to various output formats including:

- Comma-separated text file (.CSV)
- Extensible Markup Language (.XML)
- MS Access Database (.MDB)
- ESRI shapefile (.SHP)
- Hypertext Markup Language (.HTM)

All or part of the data currently displayed in a grid can be exported. To export selected data from a grid, the data must first be selected. Data selection can be performed by either selecting desired rows, or using the tools provided in HydroGeo Analyst. These tools include those that are used to filter data such as “Filter By Selection” and “Hide selected rows”.

The selected data can then be exported by either selecting the “Export” option from the “Project” menu, or by right-clicking in the grid and selecting the “Export” pop-up menu

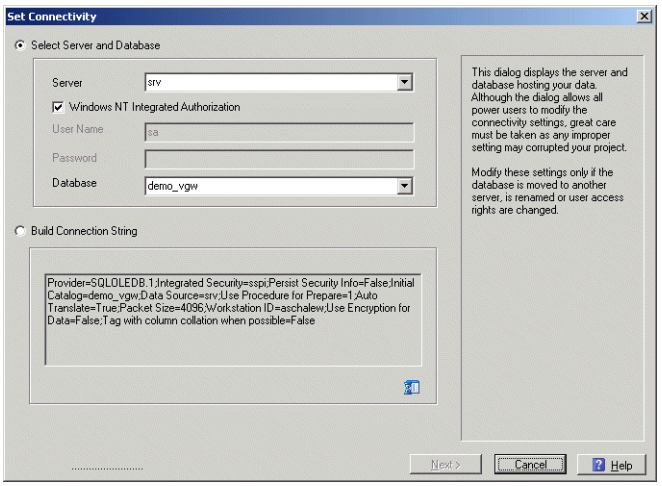
item. Once the file dialog appears, the desired export destination can be selected by choosing one of the file types corresponding to the supported destination listed earlier in this section.

Properties

This menu item will load a window displaying the properties for the current project. Once a project is created, there are options to modify some of the project settings. These are explained below.

Connectivity

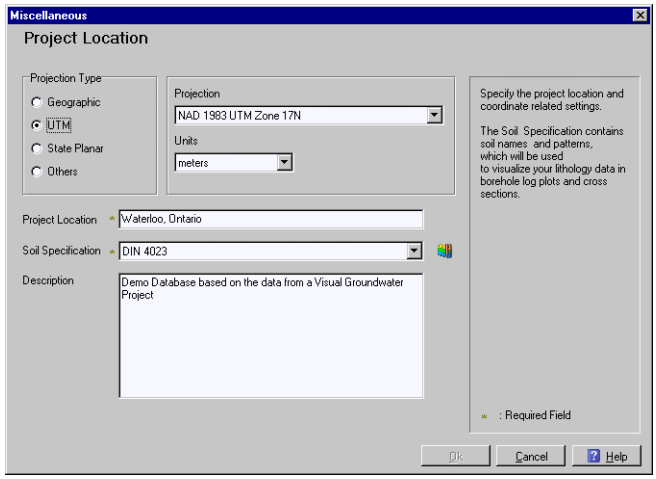
This option allows you to check the database connection settings for the current project If the connection is lost, or the server is modified, the connectivity settings can be redefined in the dialog shown below.


Set Connectivity
Select Server and Database
Server
srv
Windows NT Integrated Authorization
User Name
sa
Password
Database
demo_vgw
Build Connection String
Provider=SQLOLEDB.1;Integrated Security=sspi;Persist Security Info=False;Initial Catalog=demo_vgw;Data Source=srv;Use Procedure for Prepare=1;Auto Translate=True;Packet Size=4096;Workstation ID=aschalew;Use Encryption for Data=False;Tag with column collation when possible=False
This dialog displays the server and database hosting your data. Although the dialog allows all power users to modify the connectivity settings, great care must be taken as any improper setting may corrupted your project.
Modify these settings only if the database is moved to another server, is renamed or user access rights are changed.
Next >
Cancel
Help

For more details on the Project Properties, please refer to Chapter 4.

Miscellaneous Settings

This dialog provides access to project coordinates and the soil classification system.



If necessary, the project projection system or the Soil Classification may be changed in this dialog.

Print

The Print option in the Project menu loads the selected grid into the Report Designer; the Print option is activated only if a grid is visible and selected. The (Print) button in the toolbar performs the same function.

For more details on printing from the Report Designer, please refer to Chapter 11: The Report Editor.

Exit

This menu item will close HydroGeo Analyst, and all related windows (if any are open).

3.2.2 Edit

The Edit menu resembles the standard Windows design, including options for Cut, Copy, Paste, and Find. Depending on the window or dialog selected, one or more items under this menu may be grayed out. The functionality of all Edit menu items are limited to grids. In a grid, only individual cells may be selected and copied, cut, and/or pasted (not the entire record).

Copy

The Copy command adds the selected item to the Clipboard. Use copy to move objects to another grid, or to copy the selected grid value to another application. Data may be

copied from a grid cell or from a text box; the entire record may not be copied with a single operation. The contents of the clipboard can be inserted into a document with the Edit / Paste command.

Cut

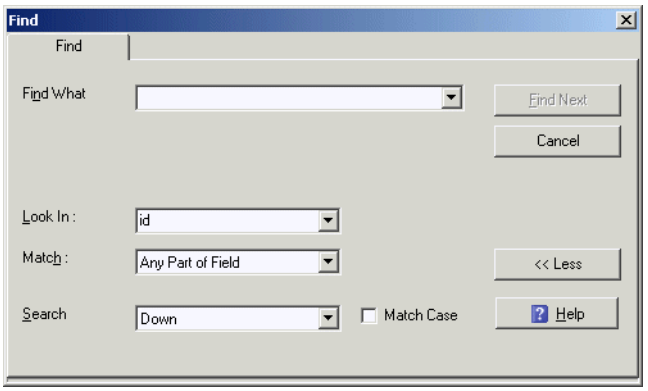
The Cut command moves the selected item to the Clipboard. Use cut to move objects to a different grid, or to move the selected values to another application. Data may be cut from a grid cell or from a text box; the entire record may not be cut with one operation. Cut deletes the selected object after copying it to the clipboard. The contents of the clipboard can be inserted into a grid with the Edit / Paste command.

Paste

The Paste command copies the Clipboard contents into the selected grid cell. If no field is selected, then this menu item will be inactive. In addition, if there is no data in the Windows clipboard, then this menu item will be inactive. Data may be pasted into a grid cell or a text box. An entire record may not be pasted in a single operation.

Find

This menu item loads the Find window with an option to search for records which satisfy the specified criteria. The Find window is shown below:



When the Find window is loaded, the value in the current grid cell receiving the focus will be identified in the **Find What** field.

Beside **Look In**, select from one of the columns in the current grid. All columns which appear in the current grid will be available for selection.

Beside **Match**, select from one of the following options:

Any Part of Field: Find will attempt to locate any part of the search term in the existing records.

Whole Field: Find will locate records which match the whole field only.

Start of Field: Find will locate records that match the start of the field.

The **More / Less** button can be used to create a simple or Advanced find. The Advanced find provides additional Search options. Beside **Search**, select from Up, Down, or All.

The **Match Case** option will match the case records with the defined option.

To execute a Find:

- Enter a word or number in the **Find What** field
- Select a grid column from the **Look In** combo box.
- Select a **Match** option.
- Specify a **Search** option (default is Down)
- Click **[Find Next].** The first record matching this criteria will be selected and highlighted in the grid.

The (Find) button in the toolbar performs the same function.

3.2.3 View

The View menu provides options for changing the appearance of the HydroGeo Analyst window by showing/hiding selected grid columns and showing/hiding the interface components.

Project Browser

Hides or displays the Project Browser.

Well Profile

Displays the Well Profile Viewer. The Well profile is a borehole log plot (BHLP) viewer integrated into the Station List grid. Select any BHLP template that is created, and select a station from the Station List. The button in the toolbar performs the same function. To hide the Well Profile Viewer, click **View** on the menu bar and then select **Well Profile**.

Hide Selected Columns

When this menu item is selected, any columns that are selected in a grid will be hidden from the current view. This can be useful for focusing on a selected criteria for a

selected group of stations. This item is only available if one or more columns have been selected in an active grid.

Show All Columns

Use the **Show All Columns** menu item to display all columns in the active grid; this will any hidden columns to the current view. This item is activated only if a grid is active and one or more columns are hidden.

Collapse All

Use the **Collapse All** command to collapse all nodes of the project browser. The selected active node will remain active after collapsing.

Expand All

Use the **Expand All** command to expand all nodes of the project browser. The selected active node will remain active after expanding. The same function is available by right-mouse clicking on the project browser.

Refresh All

Use the **View / Refresh** item to refresh all nodes of the project browser, as well as the active grid, with data from the database. It is useful to Refresh the view after making changes to the database template, or modifying stations or station groups. You can perform the same function by clicking the (Refresh) button in the toolbar or by right-clicking in the browser window and selecting **Refresh All**.

3.2.4 Record

The Record menu provides several options for performing activities which affect the records (rows) within a grid. This includes stations in the **Station List**, and rows in the **Data Categories**. These menu items are context sensitive, which means that the menu items will perform different functions depending on which grid is active.

NOTE: The Record menu items are only available when a grid is active, and the cursor is located within the grid.

A detailed description of each menu item is provided below.

Add

The Add option adds a record to the last row of the active grid. Records may be added to the grids in the various Data Categories in the **Station Data** tab, or added as stations in the **Station List** tab. You can perform the same function by pressing the (Add) button in the toolbar or right clicking on the grid and choosing **Add**.

If the record being added is a new station, the new station will always be added to the **Project** Station Group, and will also be added to any station group that is active and selected at the time.

After a record has been added to the grid, the changes should be saved using either the (Post Data) button in the toolbar, or the **Post** menu item in the **Records** menu.

Delete

Use the Delete option to delete the selected record(s) from a grid. A station record may be deleted from the **Stations List**, or a data record (row) may be deleted from the selected grid in any of the data categories. The (Delete) button in the toolbar performs the same function.

NOTE: Use caution when deleting stations from the Project station group, as they will be permanently deleted from the database.

Duplicate

Use the Duplicate option to create a duplicate of the selected record in the active grid; the new duplicated record will be added to the last row of the grid. This can be used to quickly copy existing records, and make minor modifications.

After the new record has been added to the grid, the changes should be saved using the (Post Data) button in the toolbar or the **Post** menu item in the **Records** menu.

Post

The Records / Post item saves all changes made in a grid to the database. The Post item is activated only if the cursor is located within a grid and there has been a change made to the grid. The button in the toolbar performs the same function.

Filter by Value

The Filter By Value option will locate and display only those records which contain matching values for a selected cell, in the selected column. Those records which do not meet the criterion will be temporarily removed from the station list. Only a value from a single cell may be selected at once. The button in the toolbar performs the same function.

All filtered records can be restored using the **Show All** menu item.

By filtering records based on a defined criterion, it will be easier to focus on a sub-set of stations, and create specific reports, plots, and cross sections. The Filter menu items are only available if the cursor is located within a grid.

Hide Selected (Rows)

Use the Hide Rows option to hide all records which are selected in a grid; all non-selected records will remain in the display. All hidden records can be restored using the **Show All** menu item. The button in the toolbar performs the same function.

Invert Selection

Use this command to select all records that are not selected, and de-select all records that are currently selected. The button in the toolbar performs the same function.

Show All

Use the Show All menu command to show all records in the database; this will restore all hidden records.

Select All

Use this menu item to select all records in the grid. This item is activated only if a grid is active.

Sort Ascending

Use the Sort Ascending option to sort records in the selected column from lowest to highest; characters are sorted from A to Z while numbers are sorted from 1 to 9. The button in the toolbar performs the same function.

Sort Descending

If chosen, this option will sort records in the selected column from highest to lowest; characters are sorted from Z to A while numbers are sorted from 9 to 1. The button in the toolbar performs the same function.

Display on Map

This menu item allows you to create a GIS map layer for the data that is being displayed in a grid. This data could be a list of stations in the **Station List** grid or the result of a well formed query that contains sufficient information. If a GIS layer is created using selected stations from any station group, elevation and top of casings will be added to the layer.

Any query that has an ID (station id), x and y coordinates for the stations in addition to any number of columns displaying desired data can be displayed on a map. Such queries should be created using the Query Builder with the “Map Ready” option selected.

The GIS layer will be created with the same name as the station group or the query. If there is an existing layer with the same name, you will be prompted to overwrite the existing layer with the new data (refresh the layer) or cancel the operation.

When displaying stations from the **Stations List** grid, you have the option of selecting one or more stations to be displayed on the map. If no records are selected but the cursor is located within the **Stations List** grid, then all displayed records will be included on the map.

For more details on the Map Manager, please see Chapter 8: Map Manager.

3.2.5 Settings

The Settings menu item provides options for modifying various HG Analyst project and component properties. Each menu item is described below:

Template Manager

The Template Manager provides options for modifying the database settings. The button in the toolbar can also be used to load the Template Manager.

For more details, please see Chapter 5: Template Manager.

List Editor

This menu item loads the List Editor which provides options to set, add, and/or delete items in a list table. The button in the toolbar performs the same function.

For more details, see the List Editor section in this chapter.

Material Specifications

This menu item loads the Material Specifications Editor which provides options for the material (soil and geological formation) specification that is currently used by the Project. The button in the toolbar performs the same function.

For more details, see the Material Specifications Editor section in this chapter.

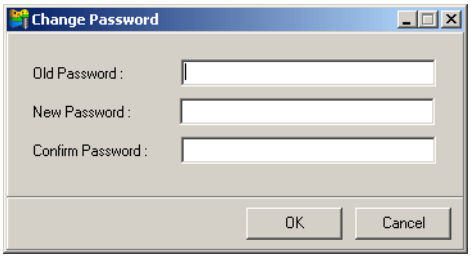
Manage User Access Level

This menu item loads the User Access Level Management System (UALM); these tools can be used to add/edit users, user groups, and assign permissions to user groups, and control how users access your projects and the HydroGeo Analyst application.

For more details, see Chapter 4: User Access Level Management.

Change Password

This menu allows you to change the project password; this feature is available for administrators only. The following dialog will appear:



Enter the **Old Password** in the first line.

Enter the **New Password** in the second line.

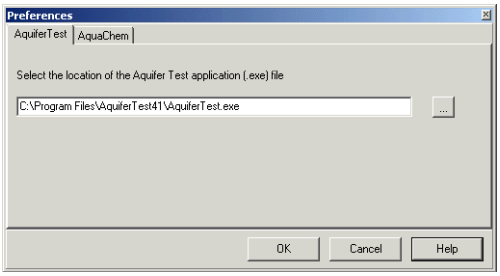
Confirm the new password in the third line.

When you are finished, click **[OK]**.

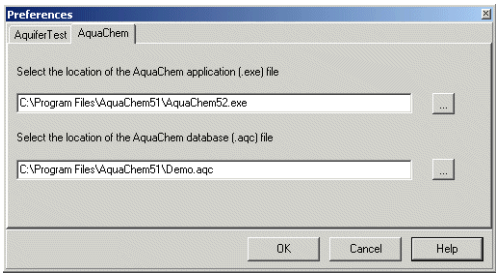
For more details, see Chapter 4: User Access Level Management.

User Preferences

In this dialog, specify the user preferences. There are several tabs explained below:



In order to use the AquiferTest analysis feature, you must first have AquiferTest 4.1 installed on the local machine, and specify where the AquiferTest.exe is located.



In order to use the AquaChem (Water Quality Analysis) feature, you must first have AquiferTest 5.1 installed on the local machine, and specify where the AquaChem51.ex is located, and where the AquaChem project file (.AQC) resides.

3.2.6 Tools

The Tools menu hosts a number of menu items which provide links to the tools and components of HydroGeo Analyst. These menu items are linked to the Project Browser, and are accessible by selecting the appropriate node in the project browser. The following sections briefly describe each item in the Tools menu.

Query Builder

This menu item loads the Query Builder, which provides options for tasks related to queries. In the Query Builder, there are options for creating new queries, or loading previous queries. The button in the toolbar performs the same function.

For more details, see Chapter 7: Queries.

Map Manager

This menu item loads the Map Manager. The Map Manager can be used for creating and viewing site maps, creating thematic and contour maps, and defining cross section lines. The button in the toolbar performs the same function.

For more details, see Chapter 8.

View Cross Section

This menu item loads the Cross Section Editor. This component can be used for defining and displaying geological, hydrogeological, and model layer cross sections. The button in the toolbar performs the same function.

For more details, see Chapter 9: Cross Section Editor.

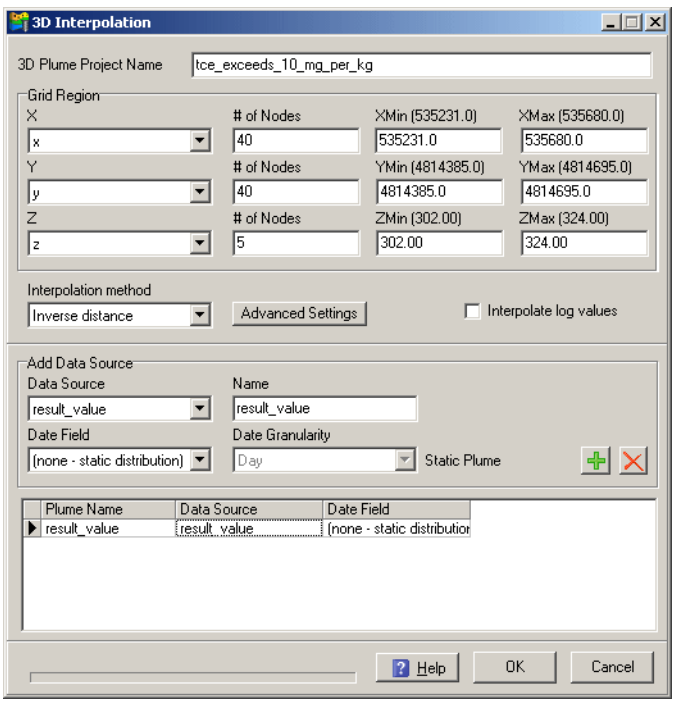
3D Interpolation

HydroGeo Analyst 3D-Explorer is now able to display and animate 3D volumetric plumes of one or more soil or groundwater contaminants. The plume is generated using the 3D Interpolator tool, then displayed with the 3D Explorer. The following section describes how to interpolate 3D points data in order to create 3D plumes; for details on viewing the plume, see Chapter 10: Plumes Display Settings.

The 3D Plume generation starts with a data set; the data set must be generated by building and executing a data query with the Query Builder. The data query should contain the data set your are interested in analyzing, along with the fields required by the 3D Interpolation. The following are required fields for the 3D interpolation, and as such, must be fields that are present in your data query:

- X
- Y
- Z (elevation of sampling point)
- Value (concentration value for one or more contaminants)
- Sample Date (if transient plume display is desired)

Once you have created a data query, you may create a 3D-Interpolated volume (plume) of the data. To access the 3D Interpolation tools, select **Tools / 3D Interpolation** from the main menu, and the following dialog will appear:



In the **3D Interpolation** window, specify the various settings related to the grid size,

extents, and data mappings.

3D Plume Project Name: Define the plume project name. One plume project can contain multiple plumes (e.g. for one or more contaminants)

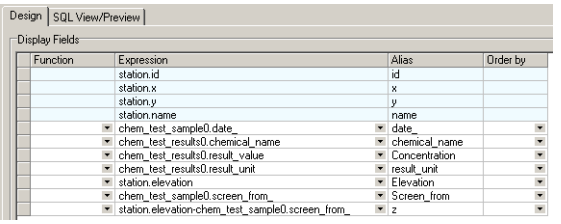
Grid Region:

Define the various properties relating to the grid size:

- **X Value**: select a field to be used for the X axis
- **# of nodes**: define the number of grid nodes in the X direction
- **X min, X max**: define the minimum and maximum X values for the interpolated grid; by default, these will be read from the data source, however you may modify these values if necessary

Similar parameters exist in the Y and Z directions.

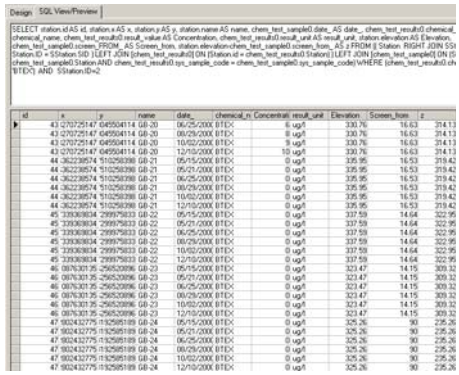
The **Z value** should be a field that represents the depth or elevation at which the data value (sample) was observed. If you want to display the plume on the same elevation scale as your cross-sections (where data is displayed as above mean sea-level) you may need to convert your sample depths to sample elevations. This can be done in the query builder, by adding a calculated display field, as shown below:



The last display field in the screenshot above, combines the sample elevation, and the screen depth (from) fields; the screen depth is subtracted from the station elevation (or station TOC elevation if desired), using the **Expression** below:

station.elevation-chem_test_sample0.screen_from_

and entering Z for the **Alias**. Executing this query, will produce the results shown below:



The last column displays the calculated sample elevations (Z). This value should be mapped to Z in the 3D Interpolation to generate your plume.

NOTE: It is recommended that the X, Y, and Z fields all be displayed with the same length units.

Interpolation method: Available interpolation methods include:

- Krigging (default), and
- Inverse distance

[Advanced Settings]: Press this button to see advanced settings for the selected interpolation method. For more details, see “Appendix D: Advanced Interpolation Settings” on page 529.

- **Interpolate log values**: This option will interpolate the log values of the data points and then invert the log value distribution. This option is useful when interpolating data with a high degree of variance.

Add Data Source

Define the various properties relating to the data source:

- **Data Source**: select a field from the data query that contains the data to be interpolated (e.g. concentration, or result value)
- **Name**: define a name for the parameter
- **Date Field**: select the field that contains the sampling date (if available)
- **Date Granularity**: This option controls how to accumulate the data items of various date stamps. For example, assume you have data for the following sample dates:
  - 5 stations sampled on 03/05/99
  - 6 stations sampled on 03/14/99 (could be from the same, or other stations)
  - 4 stations sampled on 03/19/99
  - 5 stations sampled on 03/27/99
  - 6 stations sampled on 04/04/99
  - 5 stations sampled on 04/15/99

- 4 stations sampled on 04/25/99

If you select **Day** for date granularity, you will obtain 7 data sets to interpolate, and

If you select **Month** for date granularity, you will obtain 2 data sets to interpolate:

- 20 stations sampled on 03/01/99, and
- 15 stations sampled on 04/01/99

In this case, the first observation from a well will be selected.

If you select **Year** for date granularity, you will obtain only one data set, that will essentially be a static plume. In this case, the first 1 data set.

When you have defined the settings, press the (Add) button to add the mapped fields; the values should then be displayed in the table at the bottom of the window.

To delete an existing 3D Plume, simply click on the (Delete) button.

When you are finished, click on the **[OK]** button.

HGA will create a 3D plume file, in the "Plumes" sub-directory for your project, with the file name provided, and the extension .nc. For example, TVOC.nc, in the directory:

D:\Program Files\HGAnalyst\Projects\Demo_Project\Plumes

To display the plume, please proceed to the instructions in Chapter 9: View 3D.

In addition, HGA will save the gridded 3D results to a .TXT file using the same file name, and in the same "Plume" sub-directory.

NOTE: Currently there is no method of opening plume projects in the Interpolation tool, to make modifications. Therefore, it is suggested that you save the data query so the 3D project can be quickly re-created.

Crosstab Report

This menu item loads the Crosstab query component, where you can generate crosstab query reports from your existing data queries. Ensure that you have a valid data query selected in the Queries node in the HGA browser, before selecting this option.

For more details, please see Chapter 7: Crosstab Queries.

Quality Control

This menu item loads the Quality Control component; with these tools, you can manage Lab Quality Control templates, and perform a quality control assessment.

For more details, please see Chapter 13: Quality Control.

Unit Converter

Use the Unit Converter to convert commonly used units from one form to another. For more details on this tool, please see the Unit Converter section in this chapter.

BackUp Database

Use this option to create a backup copy of the SQL Server database used by the current project. A backup of the database is helpful, in order to preserve data, or to detach and send the database to colleagues or WHI Technical support.

Select this menu item and provide a name and directory path for the file. It will be saved with the .BAK extension.

If the entire project is to be backed up, simply make a copy of the HGA project folder; however, if you have map projects in another directory, then copy these additional folders as well.

NOTE: Backup and restore works only if you are running HGA on the system that also hosts the server; the server can be MSDE or SQL Server.

NOTE: SQL Server does not permit saving the back up copy of the database to a mapped network drive; it can be saved only to a local drive.

Restore Database

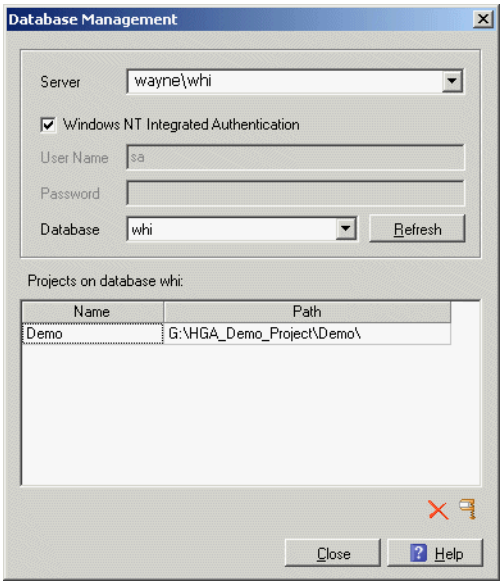
Use this option to restore the SQL Server database, in case of accidental data deletion, or loss due to mechanical failure.

Before selecting this option, ensure that the appropriate HydroGeo Analyst project is open. Then, select the **Restore Database** option, and locate the .BAK file, which was created using the Tools / Backup database option.

NOTE: If you are using SQL Server 2005 Express, you cannot restore a database that was backed up using Microsoft SQL Server Desktop Engine 2000 (MSDE).

Manage Databases

Use this option to remove unwanted databases from the local or network instances of WHI SQL Express. This option is available when HGA is first loaded, and no projects have been opened. The following dialog shows the options that are available.



In this dialog, select the Server and the Database that you would like to delete. Once the database is selected, a list of projects using the selected database will be listed at the bottom; the project list is read-only, and displayed in order to assist you to decide if the selected database can be safely deleted.

Click on the button to delete the selected database.

Click on the button, to compress the file size of the database, to save disk space. After the database has been compressed, you may continue to work with it.

NOTE: Use caution when deleting databases, since the data cannot be recovered once deleted, and there is no “undo” option unless you have taken a backup.

Deleting a database does not remove all the files that are related to the projects using the deleted database.

NOTE: Databases may be removed only from the WHI SQL Express instance. Databases from other instances of SQL Express or on a SQL Server cannot be removed through HGA.

Pumping Test Analysis

Use this feature to analyze pumping test data in AquiferTest. For this feature, you must have one or more data queries that contains the required fields for a pumping test analysis, namely:

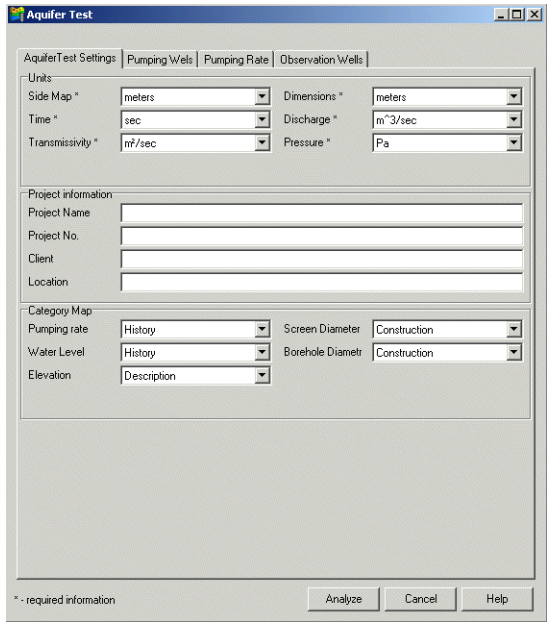
- Well Name
- X Co-ordinate (for both Pumping Wells and Observation Wells)
- Y Co-ordinate (for both Pumping Wells and Observation Wells)

- Pumping Start
- Pumping End
- Pumping Rate
- Observed time
- Observed depth to water level

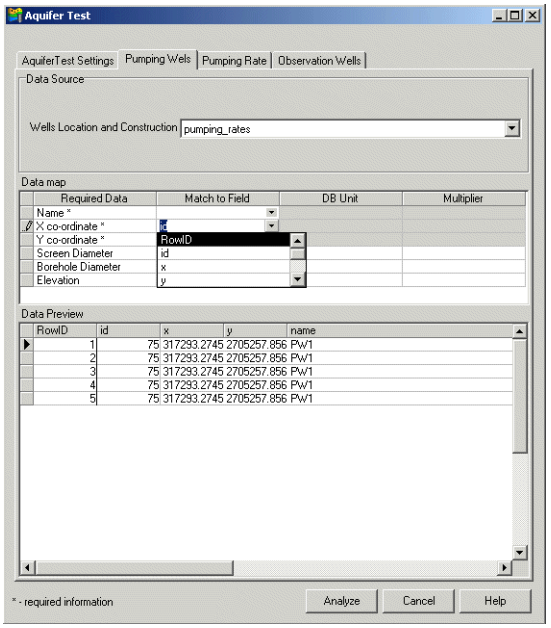
Additional fields may also be mapped and the data sent to AquiferTest; these include:

- Well Elevation
- Screen Diameter
- Borehole Diameter

The following section describes these settings:

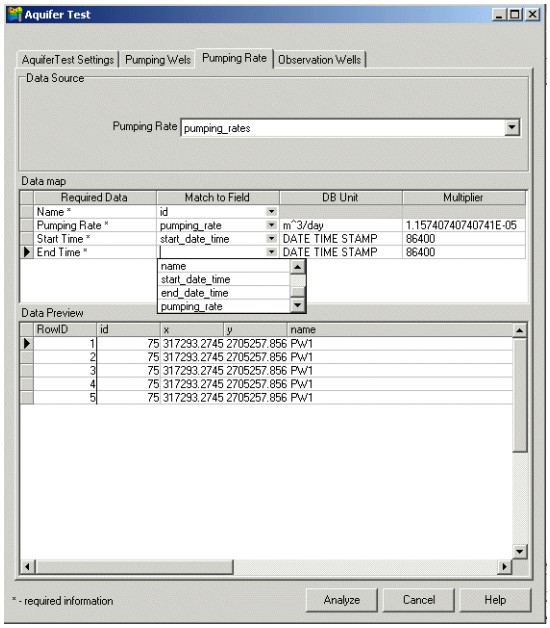


In the first tab, define the project units you would like to use for AquiferTest, and populate the Pumping Test information.

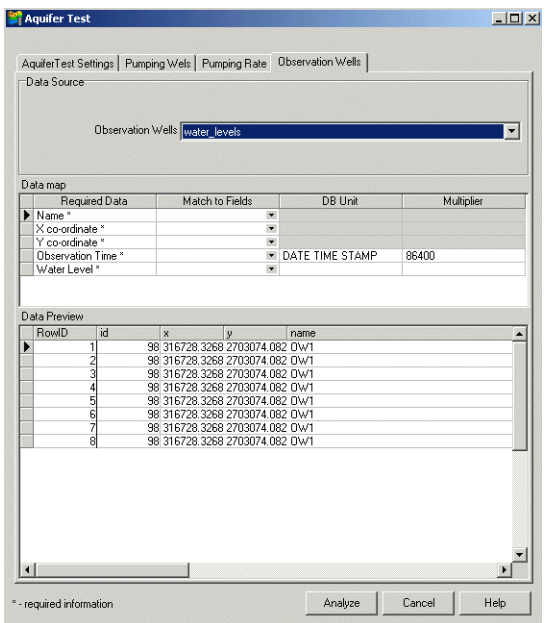


In the Pumping Wells tab, select the data query that contains the required fields for this module, for your pumping test analysis. Then, in the grid below, map the appropriate field to each required field. If the unit for the field is defined in the database template, then the unit will be automatically populated. Otherwise, this will be left blank. If needed, you can manually enter a conversion factor, to convert the data from the HGA source, to the AquiferTest project target units.

NOTE: For station X,Y co-ordinates, the AquiferTest project units must be the same as the unit system used for the HGA project (for example, if your HGA project is using UTM, set the AquiferTest units as meters; for some State Plane, set the AquiferTest units as feet). Currently, there is no conversion for these units.



In the Pumping Rates tab, the workflow is the same as earlier mentioned. In this tab, you must map the well name, pumping rate, and the start and end interval.



In the Observation Wells tab, the workflow is the same as earlier mentioned. In this tab, you must map the well name, X,Y coordinate, and the observation date/time and observed depth to water level

Once all the required fields are defined, click the Analyze button to send the data to AquiferTest. For more details on how to use AquiferTest, please refer to the AquiferTest User's Manual.

Water Quality Analysis

Use this feature to analyze water quality data in AquaChem. Select a few stations (or a station group) from the station list, then select the menu item, and AquaChem will launch, with the selected stations. For more details on how to use AquaChem, please refer to the AquaChem User's Manual

When using AquaChem with HGA, keep in mind that AquaChem is intended only for its presentation and calculation features. Data entry and maintenance operations should be performed centrally through the HGA interface and not the AquaChem interface. The operations that must be performed in HGA include:

- Creating or modifying parameters
- Importing data
- Creating new samples or modifying sample information
- Creating new stations or modifying station information.

Also, the following operations are unavailable in AquaChem:

- Creating a new database (instead the .aqc file can be simply copied and distributed)
- Compressing the database (if required, this can be done by opening the database in the MS Access environment)

3.2.7 Help

Contents

Displays the HydroGeo Analyst On-line Help.

About

Displays the HydroGeo Analyst Info dialog. This contains the HydroGeo Analyst version number and information on how to contact Waterloo Hydrogeologic, Inc.

3.3 Template Manager

3.3.1 Purpose

The Template Manager provides the tools to modify the HydroGeo Analyst database structure, and define user-level views.

3.3.2 General Description

The Template Manager captures the schema of the database and displays database and user settings. The following features are available to all users:

- Adding and deleting tables/fields
- Altering the properties of each table and field
- Grouping tables under logical data categories
- Defining visibility of tables and/or fields
- Defining user level table and/or field names, units, and data formats (where applicable).

Some of the features in the Template Manager are available only for database administrators (referred to as Power Users in the context of HydroGeo Analyst). These features include all operations that alter the database schema and table and field designs. Features that are accessible only to Power Users include:

- Adding/deleting tables and/or fields, defining primary keys, defining relationships between tables
- Save user templates as a new database schema structure
- Export user templates to a stand alone XML file
- Set any selected user template as the default template for all new users
- Rename fields, add fields to data categories, and modify the field formats
- All features that are available to all users

For more details, please refer to Chapter 5: Template Manager.

3.4 List Editor

The HydroGeo Analyst package includes a List Editor tool that provides the ability to create and customize lists for any field - allowing for efficient and effective data entry. A list in HydroGeo Analyst may be considered as a lookup table.

Linked Lists contain a specific list of values that may be used to supply a list of potential values for one or more fields. Linked lists are especially convenient if the number of values for a field is fixed and limited. Linked Lists may be created manually, generated from existing data in the project, or may be imported from an external source (text, spreadsheet, or another database).

In HydroGeo Analyst, there are several examples of linked lists. One example can be found in the “Soil Sampling” category, in the Soil Chemistry table. A combo box populated with a list of chemicals is provided for each cell under the “Chemical Name” field (column). Simply click on the combo box in any cell under this column, and a list of chemical names is displayed for the selection. This field is linked to a list of chemicals. This eliminates the step of having to re-enter chemical names in this field for each sample and minimizes any error that may occur as a result.

Below are some examples of using linked lists that you may create for the demonstration project:

[1] In the “Stations” table located under the “Description” category, it may be useful to create a field named “County” or “Municipality”, in order to organize stations (wells). Often stations for the project lie within a specific county or municipality. It is easier to create this list (that may be expanded as desired), and link it to the “County” or “Municipality” field. Then, when it is necessary to enter data for the stations, the County may be selected from a list contained within a combo box; this eliminates the task of continually re-typing the same values.

[2] In the “Geologic Description” category, Lithology table, it may be convenient to define a Linked List for the Soil Color field. The list may contain generic soil colors (ex. light-brown, dark-brown, black, grey, etc.). When the time comes to enter data for this field, the color may be selected from this linked list contained within a combo box, instead of re-entering the same values.

If the selected field contains a linked list, then a combo box arrow will appear on the right side of the field. Click on this arrow to view the available list items for the field.

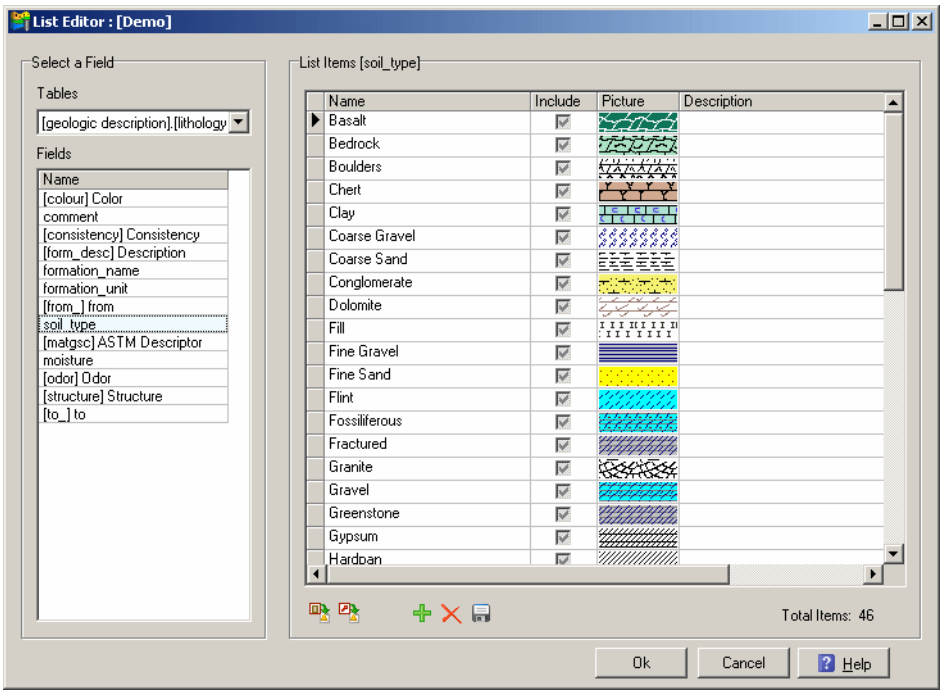
3.4.1 Creating a List

Lists (lookup tables) can be created using the List Editor which can be launched by selecting the **List Editor** menu option from the **Settings** menu or simply by clicking on the (List Editor) button on the toolbar.

The List Editor can also be loaded from the Template Manager as described under the section “Launching the List Editor from the Template Manager” on page 148, below. In the Template Manager, select the field for which a list is desired, then click the **[Edit**

List] button to load the List Editor. This will allow for creating/editing a list for the selected field.

The following figure depicts an instance of the List Editor.



The List Editor window contains the following parts:

- The **Tables** combo box: Allows you to select the table containing the field for which a list is to be created or modified.
- **Fields**: Allows you to select a field for which a list is to be created or modified.
- **List Items**: Displays the list for the selected field if available. Each list item may have a Name, Image, and Description.

Adding Lists Manually

To create the list for a particular field, follow the steps below:

- Select the **Table** and **Field** for which a List is to be created.
- Click the (Add) button to add a list item
- In the first column, enter a **Name** for the list item.
- If necessary, define a **Picture** for the list item. Click in the **Picture** column, and a dialog will appear with options to load the desired graphics for the list item.
- Click in the “Check box” under the **Include** column in order to make this list item available to HydroGeo Analyst. List items can be turned on/off as desired

in order to limit the amount of items displayed in HydroGeo Analyst. For example, a list of chemical names, only certain groups of chemicals may be needed at times. In those circumstances, the list can be shortened by turning off all unnecessary groups of chemicals.

- Enter a **Description** for the list item, if necessary.
- Repeat these steps to add additional list items, until the desired list is created
- Click the button to save the list
- Once the list has been created, use the Template Manager to link this list to the selected field. See the section "Launching the List Editor from the Template Manager" on page 148, for more details.

Generating Lists

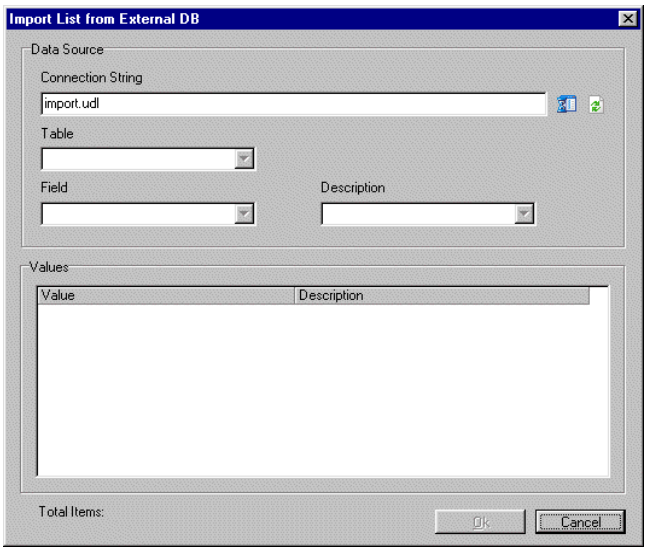
List items may also be generated using existing data. The data could be an existing value in the current database for the selected field, or could be a list from an external source. To extract all existing unique entries from the current database for the selected field:

- Using the procedure described above, load the List Editor, and select the appropriate table and field for the list.
- Click on the (Import from current database) button at the bottom of the window. The List Editor extracts all unique entries that have already been entered (if any) into the current database under the selected field. Once this is completed, a verification dialog will appear displaying the number of entries returned for this field.
- Click **[Yes]** to import these values to the list.
- Edit the list as desired by adding or removing items.
- Click the button to save the list
- Once the list has been created, use the Template Manager to link this list to the selected field. See the section "Launching the List Editor from the Template Manager" on page 148, for more details.

Importing Lists

The list items may also be imported from an external data source. To do so,

- Using the procedure described above, load the List Editor, and select the appropriate table and field for which a list is to be imported.
- Click on the (Import from external database) button at the bottom of the window. The following dialog will appear.



- Click the "**Data source**" button in the upper-right corner of the dialog.
- The **Data Link Properties** dialog will appear. Select the desired data source. For help using the Data Link Properties, please refer to Appendix B.
- Click **[OK]** on the **Data Link Properties** dialog to close.
- Click on the **"Refresh"** button to refresh the dialog with information from the selected data source. A list of tables (if any are available) will appear in the "Tables" combo box.
- Select the **Table** that contains the list to be imported.
- Select the **Field** (column) in this table which contains the **Values** for the list.
- Select the **Field** (column) that contains the **Description** if necessary.
- The list items for this field will appear in the preview frame in the lower half of the window.
- Once satisfied with the content of the list, click on the **[OK]** button to start importing the list.
- In the List Editor window, press the (Save) button to save the list items.
- Once the list has been created, use the Template Manager to link this list to the selected field. See the section "Launching the List Editor from the Template Manager" on page 148, for more details.

3.4.2 Editing a List

The following editing options are available in the List Editor:

- Delete a list item by selecting it and pressing the (Delete) button.
- Move the list item by selecting it and dragging it up or down to a new position in the list.

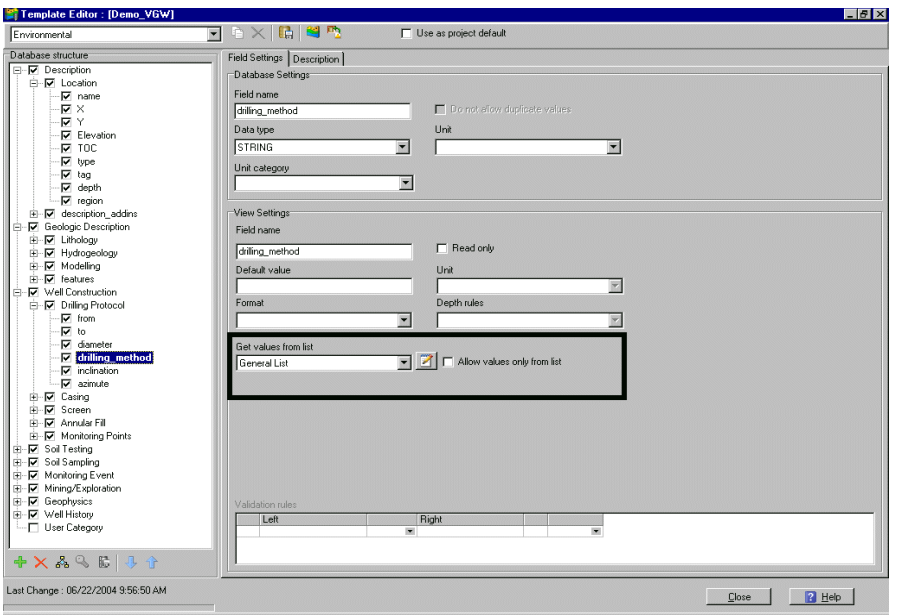
- Edit the list item by selecting it and making necessary changes.
- Once the editing is complete, click the (Save) button to save changes.

3.4.3 Launching the List Editor from the Template Manager

The List Editor can also be launched from the Template Manager. The Template Manager allows you to link a selected field to a list of distinct values that may be used as values for the field.

To link a list to a selected field,

- Select **Settings / Template Manager** or click the button from the toolbar. The Template Manager window will load.
- From the tree view on the left side, select the appropriate **Data Category,** and select the appropriate table and the desired field.
- Locate the **View Settings** options in the lower half of the window, as indicated in the figure below:



- Select a "**General List**" from the "**Get Values from List"** combo box.
- If the field should be fixed to contain only values from the list, enable the option **Allow Values only from List**, by placing a check mark in the check box.
- If the list items should be read-only in the field, then place a check mark in the box beside **Read-Only**.
- If necessary, press the (Edit List) button to load the List Editor to edit the list.

- Press the (Save) button to save the changes to the template, and close.

The list items should now show up for the selected field (column) in HydroGeo Analyst. Fields that contain a linked list will contain an arrow with a combo box on the right side of the field. Simply click on this arrow to see the list items available for the field.

NOTE: If you want to re-use these lists in a new HGA project, you must save the current database template. Then, create a new project with this database template, and the lists will be included. For details on saving database templates, see Chapter 5: Exporting the current template as a Database template.

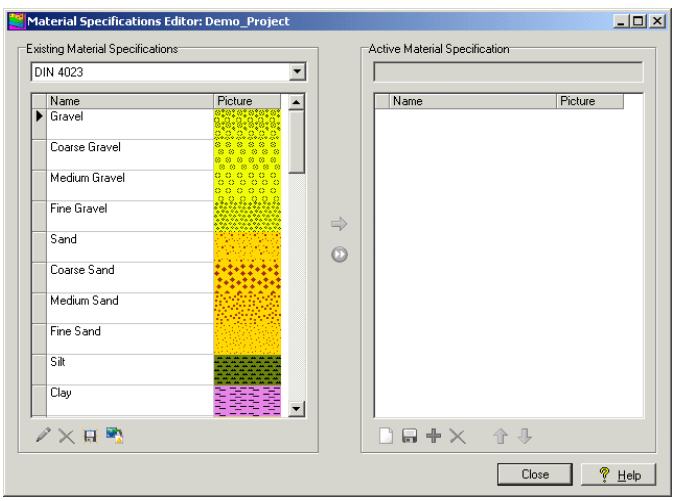
3.5 Material Specifications Editor

The Material Specifications Editor provides options for editing material specifications, specifically creating/editing soil classifications for your project. This Editor displays a list of standard soil specifications shipped with HydroGeo Analyst, and allows the display of the soil type names and patterns for each classification.

The Material Specifications Editor may be launched from two locations:

- Select the **Material Specifications** option from the **Settings** menu, or click on the button in the toolbar.
- In the Project Wizard, click the button provided in Step 4 (Provide Project Settings).

The Material Specifications Editor will appear, as shown in the following screenshot:



The left side of the window displays the soil types belonging to the selected Soil Classification System (SCS) (which may be chosen from the combo box in the upper left corner). The right side of the window provides the interface for editing an existing

custom material specification or creating a new one.

In the lower-left corner of the window, there are four buttons:

- Use the button to modify the selected SCS
- Use the button to delete the SCS
- Use the button to set the selected SCS as the project default
- Use the button to export the SCS

In the lower-right corner, there are several buttons that control the soils belonging to a SCS:

- Use the button to create a New SCS
- Use the button to save the SCS
- Use the button to add a new soil
- Use the button to delete the selected soil
- Use the button to move the selected soil type up
- Use the button to move the selected soil type down

3.5.1 Creating a New Soil Classification System

To create a new Soil Classification system (SCS), follow the steps below:

- Click the (New) button.
- Enter a name for the SCS.
- You may now proceed to create or add soil types to this SCS. Soil types may be added manually, or copied from an existing SCS.

To add new soil types manually,

- Press the (Add) button (in the lower right corner)
- Enter a **Name** for the new soil type, and select a **Pattern**. To select from one of the available patterns, select the [...] button beside the soil type, and choose from one of the pre-existing images for the soil pattern. To use your own image, right mouse click on the picture field, select “Get Own Picture”, and locate the image file.

To copy one or all soil types from an existing SCS into the new SCS, use the following buttons:

- Choose the desired SCS from the **left** side of the window.
- To copy a single soil type, use the button.
- To copy all soil types, use the button.

Use the following buttons to arrange the order of the soil types within the selected SCS.

- To move the selected soil type up, use the button.
- To move the selected soil type down, use the button.

To delete the selected soil type within a SCS, press the button.

Press the (Save) button to save the current SCS settings.

NOTE: If you want to re-use this new SCS in a new project, you must save the current database template. Then, create a new project with this database template, and the SCS will be available. For details on saving database templates, see Chapter 5: Exporting the current template as a Database template.

3.5.2 Modifying and Deleting a Soil Classification System

To modify an SCS, select the desired SCS, then use the button to load this into the edit window on the right.

To delete an SCS, select the desired SCS, then use the button on the lower-left corner of the window.

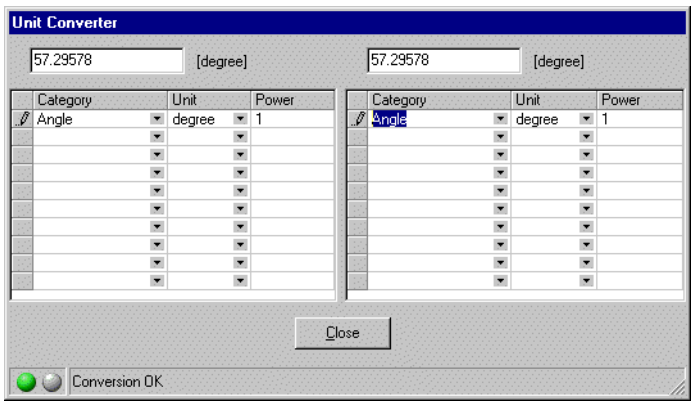
NOTE: Only user-defined Soil Specifications can be modified or deleted. The Default Specifications USDA, USCS, DIN 2043, Compton's, IAH may not be modified or deleted from the project.

3.5.3 Changing Soil Classifications

Once a project has been created, it is recommended that the SCS not be changed; the reason for this is that existing cross sections with defined geology will be impacted by changing the soil names and patterns. However, if it is necessary to change the SCS, this may be done in the Miscellaneous Settings dialog, available under the Project / Properties menu.

3.6 Unit Converter

The Unit Converter may be used to convert commonly used units from one form to another. Select **Tools / Unit Converter** from the menu, and the following dialog will appear.



To use the Unit Converter,

- Select a unit category from the left side panel;
- Select a unit for this category.
- Then, select a unit category from the right side panel;
- Select a unit for this category.

The conversion factor will appear in the fields at the top of the dialog.

3.7 Major Components

The major components of HG Analyst have separate chapters devoted to an in-depth discussion of the features and capabilities of each component. The following components are discussed at length in subsequent chapters:

[1] **Project Manager:** The Project Manager provides a wizard for creating a new HydroGeo Analyst project and an interface for modifying the properties and settings of existing projects.For existing projects, the Project Manager can be called to see the project properties. When a new project is created, the Project Manager is called in the form of a Wizard. To load the Project Wizard for new projects, select **Project / New** from the main menu. The wizard displays several windows in an easy-to use interface, as described below.

- **Database Environment**: In this window, specify the database which will be used for the HG Analyst project, and the necessary connection string.
- **Database Template Properties**: Select a database structure from a list of available templates; or create a new database template
- **Project Information**: In this window, specify the project name, project folder, and clients
- **Project Settings**: Specify the project location, projection system, units, and specify the SCS (soil) settings for the project.

For more details, please refer to Chapter 4.

[2] **Template Manager:** The Template Manager provides tools to modify the HydroGeo Analyst database structure, and define user-level views. The Template Manager captures the schema of the database and displays database and user settings. Some of the features in the Template Manager are available only for database administrators (referred to as Power Users in the context of HydroGeo Analyst). These features include all operations that alter the database schema and table and field designs. Features that are accessible only to Power Users include:

- Adding/deleting tables and/or fields, defining primary keys, defining relationships between tables
- Save user templates as a new database schema structure
- Export user templates to a stand alone XML file

- Set any selected user template as the default template for all new users
- Rename fields, add fields to data categories, and modify the field formats
- All features that are available to all users

For more details, please refer to Chapter 5: Template Manager.

[3] **Data Transfer System:** The Data Transfer System (DTS) provides an easy-to-use interface for importing data into, or exporting data from, a HydroGeo Analyst project. The DTS in HydroGeo Analyst is designed to allow for efficient data transfer between the database and external applications. Data may be quickly imported into new or existing projects from various formats. When creating a new project, it may be necessary to import data from other sources into the HG Analyst database. Data may exist in sources such as MS Access, SQL server, Oracle databases, or in text files or spreadsheets. The DTS is designed to import data from these sources into the HG Analyst Project database. In addition, data may be exchanged (import and/or export) between the project database and various other data sources during the lifetime of the project. Such imports/exports in most cases will involve the project database and other sources such as spreadsheets, delimited text files, and even other databases such as MS Access. The current version of the DTS is designed to:

- Import data into the HG Analyst database from such sources as:
  - Spreadsheets (e.g. Excel, Quattro Pro, Lotus 123)
  - Delimited Text files (e.g. Comma, Tab delimited text files)
  - Other databases (e.g. from one or more tables in a MS Access database)
- Export selected data to destinations such as:
  - Spreadsheets (e.g. Excel, Quattro Pro., Lotus 123)
  - Text files
  - Other databases (e.g. to a table in a MS Access database)
- Export one or more HydroGeo Analyst tables to an external database (MS Access, SQL Server)

For more details, please refer to Chapter 6: The Data Transfer System.

[4] **Query Builder:** The Query Builder provides the tools for creating and managing station groups and simple or advanced data queries. Within a HydroGeo Analyst project, it may be necessary to perform different types of queries for data filtering, management, and creating customized charts, maps, cross-sections, and reports. The Query Builder provides the tools for such tasks. A few examples of queries are provided below:

- Select wells drilled later than 1995 and earlier than 2000.
- Select wells with discharge over 250 gpm.
- Select boreholes deeper than 150 feet, and penetrating a sandy-gravel layer
- Select boreholes with the overburden thickness more than 10 m

The Query Builder is capable of creating two types of queries:

- Station Group Queries: Used to sort HydroGeo Analyst stations into logical groups;
- Data Queries: Used for creating specialized reports or map layers

For more details, please refer to Chapter 7: Queries.

[5] **Map Manager:** The Map Manager is an easy-to-use GIS tool for mapping HydroGeo Analyst station data. The mapping component associated with HydroGeo Analyst is designed to provide a tool for overlaying and displaying site maps, so that station data may be related to surficial base map features. The Map Manager allows site maps to be imported from various formats, including *.DXF, *.BMP, *.JPF, *.GIF, and ESRI Shape (*.SHP) files from other applications. In addition to loading base maps, the Map Manager tool also provides the following options:

- Georeference and import raster image maps;
- Create Annotation layers for drawing and labeling;
- Display Station Groups or Station Queries from the HydroGeo Analyst project as a Map Layer in the Map Project;
- Create contour maps of selected fields (eg. Elevation, GW Elevation, concentrations);
- Create Thematic Maps: Bar and Pie Charts of selected fields;
- Send maps to the Report Editor for printing
- Created girded data file (.GRD)

For more details, please refer to Chapter 8: Map Manager.

[6] **Cross Section Editor:** The Cross-Section Editor provides an interface for viewing two-dimensional geological cross sections for borehole data, and creating and interpreting cross section layers. Cross sectional layers can be digitized using conventional GIS drawing tools. Once the cross-sections have been defined, the images may be loaded into the Report Editor for printing; or the cross-section image may be exported to a graphics file format. Additionally, one or more cross sections may be sent to the 3D Explorer, for viewing site lithology in a fence diagram format.The Cross-Section Editor allows for three types of layer interpretations:

- Geologic: layers that define the geologic layers (eg. sand, clay, till, bedrock, etc.) for the displayed stations.
- Hydrogeologic: layers that define the hydrogeologic layers (eg. Aquifer1, Aquitard1, Upper Unconfined, etc.) for the displayed stations.
- Model: layers that define unique model layers (eg. Model Layer 1, Model Layer

2, etc.) for the displayed stations. Model layers may be used in numerical groundwater flow models.

For more details, please refer to Chapter 9: Cross Section Editor.

[7] **3D Explorer:** The HG Analyst 3D Explorer provides a three-dimensional view of one or more cross-sections defined in the Cross Section Editor. Specifically, this can be used to display multiple cross sections in the form of fence diagrams using a variety of three-dimensional graphical formats. Additionally, base maps may be displayed for relating the fence diagrams to surface features. The graphical tools and presentation formats available are specifically designed for viewing geology and hydrogeology data. The HydroGeo Analyst 3D-Explorer uses state-of-the-art 3D graphics technology to display your data and sampling results using:

- 2D and 3D views of the grid
- Bitmap overlays on surfaces
- Enhanced label positioning and controls
- Light source position control
- Transparent objects
- Animation sequence pausing and looping
- Auto-rotate tools to continuously rotate the model image around the X, Y, Z axis
- ...and much more.

For more details, please refer to Chapter 10: HydroGeo Analyst 3D-Explorer.

[8] **Report Editor:** The Report Editor provides an interface to create reports and report templates containing a variety of data from a HydroGeo Analyst project. The Report Editor included with the HydroGeo Analyst package is used to create professional reports containing data, and/or 2D and 3D-views you have generated with your projects. Reports can be printed, or exported to conventional formats (.RTF, .PDF, .HTML, etc.).

The Report Editor provides the following features:

- Create and save Report Layout Templates
- Create and Manage Reports
- Import Reports
- Design and Preview Reports
- Save, Export, and Print Reports

In addition, the Report Editor:

- Provides an easy-to-use Office-like designer environment
- Supports VBScript and JScript events and expressions
- Provides Barcode control

- Allows report bookmarks and internet hyperlinks

For more details, please refer to Chapter 11: The Report Editor.

[9] **BHLP Designer:** The Borehole Log Plot designer provides the tools for designing borehole logs plots for your station data. The number of columns, and their order of display, is flexible and can be modified in an existing borehole log plot template, or a brand new template can be created. Borehole log plots can be created for one or more boreholes at once based on a desired borehole log plot design template. Once the design is acceptable, a borehole log report can be generated through the use of the Report Editor, for one or multiple boreholes.Information related to a borehole that may be displayed through the plotter includes:

- Lithology information for each formation
- Description of the geologic formation
- The depth and or elevation of each layer
- Well construction details (casing, screens, annular fill)
- Charts that display one or more data types collected at various depths in the well including those resulting from geophysical investigations
- Symbols showing sample locations, groundwater levels, etc.
- ...and much more, using Data Tables and Query Results

For more details, please refer to Chapter 12: Borehole Log Plotter

4

Project Management

Project Management is an essential component of any environmental project. HydroGeo Analyst provides the tools you need to manage user access to your projects, selecting database schemas, and geographical details.

The first section of this chapter, 4.1: User Access Level Management, describes tools for managing how users access your HGA projects.

The second section, 4.2: Using the Project Manager, describes the process of creating new projects, and the options available.

4.1 User Access Level Management

4.1.1 Introduction

The User Access Level Management (UALM) component allows protecting both file based data (e.g. model inputs, outputs, etc.) as well as database based data (e.g. data stored in HGA). The following features are available:

- Create and manage user groups (i.e. create, edit, delete, user groups)
- Manage users in user groups (i.e. add, remove, edit users in existing user groups)
- Assign access rights to User Groups for each object (Data Management, Maps, Cross-Sections, etc.)
- Set user ID, names, description, and access passwords for users
- Enforce access levels for each user group as per the specified security document
- Store Users and User Groups in database templates, for re-use in future projects.

HydroGeo Analyst has two levels of user access management:

- Application Level - used to control high level features such as creating new projects and managing databases; and
- Project level - used to control access to individual modules within a project; e.g.

Data access, maps, queries, BHLP, etc.

NOTE: HGA enforces user access to HGA projects only. The SQL Server database that stores the HGA data can be accessed by any user, using Enterprise Manager, provided they have the permissions. SQL Server Enterprise Manager provides similar tools that allows for user access management, and should be utilized as needed.

4.1.2 Security Document

The user access management settings are stored in a Security Document. This is a document that contains user groups, users, system security policies, access rights to application and project level objects. This document is created using the User Access Level Management component and is managed by HGA.

In HGA, there are two types of security documents:

- Application Level Security Document (ALSD) - used to control access to high level features such as managing databases, creating new projects, and the user access management.
- Project Level Security Document (PLSD) - used to control access to individual projects as well as the data and modules within this project.

The settings for the ALSD are encrypted and saved in the ALSD.whi file, which is copied to your HGA installation directory during the installation (default is \Program Files\HGAnalyst). The ASLD contains one default user group (Administrators) and one user (Admin) with no password. After installation, the Administrator can launch HGA, login with the default user credentials and customize the default Administrator user and Administrators user group.

NOTE: At least one user must belong to the Administrator user group at all times.

If you are working on a network, and you want other users to have the same ALSD settings that you have defined, then these users must have the same ALSD.whi file in their HGA installation folder. Simply copy the file to the target machine, and overwrite when prompted.

The settings for the PLSD are saved in the PLSD table, which is an encrypted table, and is created for each HGA project.

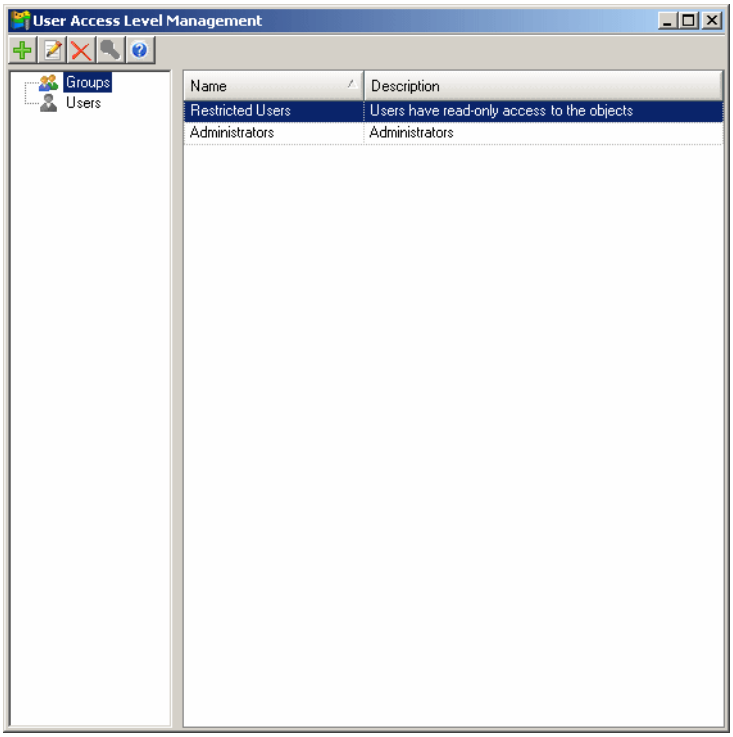
4.1.3 Managing Users and Groups

The User Access Level Management (UALM) module is loaded from the main window of HGA, by selecting **Settings / Manage User Access Levels** from the main menu.

If you load the User Access Management component and there is no project opened, then you will be able to modify the options for managing Application Level objects.

If you load the User Access Management component and a project is currently opened, then you will be able to modify options for managing Project Level objects.

In both cases, the following main window will appear:



The UALM window contains the tools for managing users and groups.

The left side of the window displays a tree with the available **Groups** and **Users**.

The main section of the window displays a table containing **Name** and **Descriptions** for the selected Group or User.

In the upper-left corner, you will find a toolbar with several context-sensitive buttons;

When **Groups** is highlighted in the tree view, the controls apply to Groups;
When **Users** is highlighted in the tree view, the controls apply to Users.

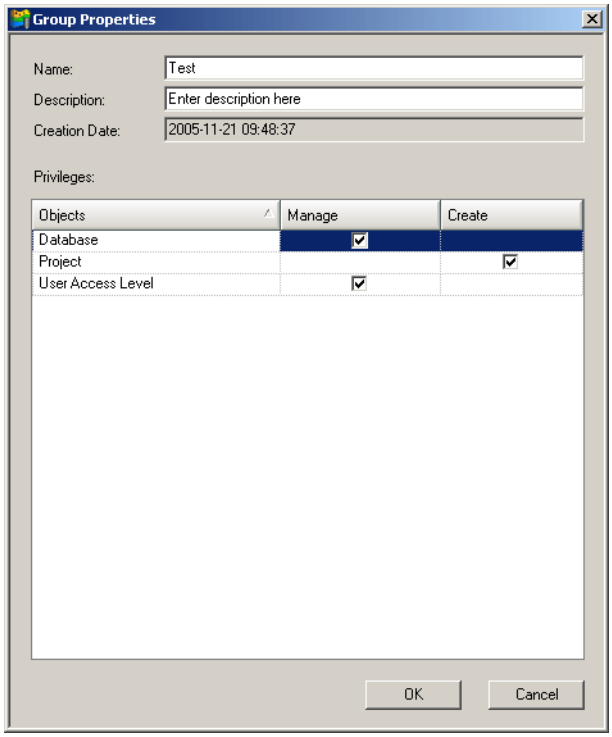
- Use the (Add) button to add a new Group or User
- Use the (Edit) button to edit the selected Group or User
- Use the (Delete) button to delete the selected Group or User
- Use the (Set Password) button to set the password for a User; this control is only enabled when a User is selected in the tree view
- Use the (Help) button to load the Help details

4.1.4 Group Properties

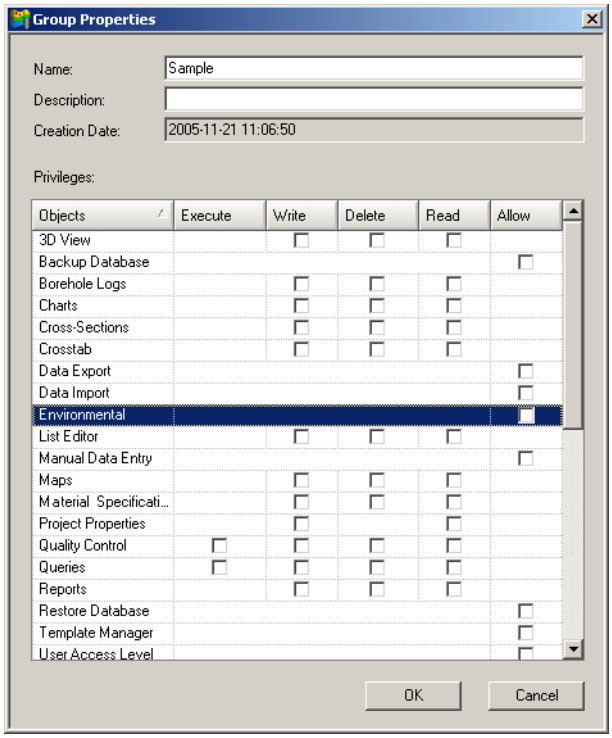
The UALM allows you to set permissions to the various modules in HydroGeo Analyst, through the Group Properties. To load these options:

- Select **Groups** from the tree view in the main UALM window
- Click on the (Add) button to add a new Group, or
- Click on the (Edit) button to edit the properties for a selected Group

When there is no HGA project loaded, the **Group Properties** dialog (for Application Level objects) will appear:



When a project is open, the **Group Properties** dialog (for Project Level objects) will be displayed as shown below:



The **Name** and **Description** for the Group can be defined by the administrator; the **Creation Date** is a read-only field, that is filled automatically by HGA; the time stamp will be read from the computer's CPU at the time of creating the group.

The **Privileges** to the various HGA objects are described further below. In HGA, an object is any item that requires access control. An object could be a dialog, a database, a table in a database, a file, a template, etc. An object may be classified into a group based on common properties such as a number of access levels (e.g. a database and a dialog may have different levels). Objects that have the same list of access levels may be grouped together. For instance, all objects that require only two levels of control (e.g. Full or Read-only access) may be grouped together.

In HGA, objects are sorted in two groups:

- Application Level
- Project Level

Simply place a check-mark in the appropriate access levels, for each object, or use the **Select All** option to enable full privileges for all objects. By default, the Administrator User Group will have full access to all objects and the ALSD.

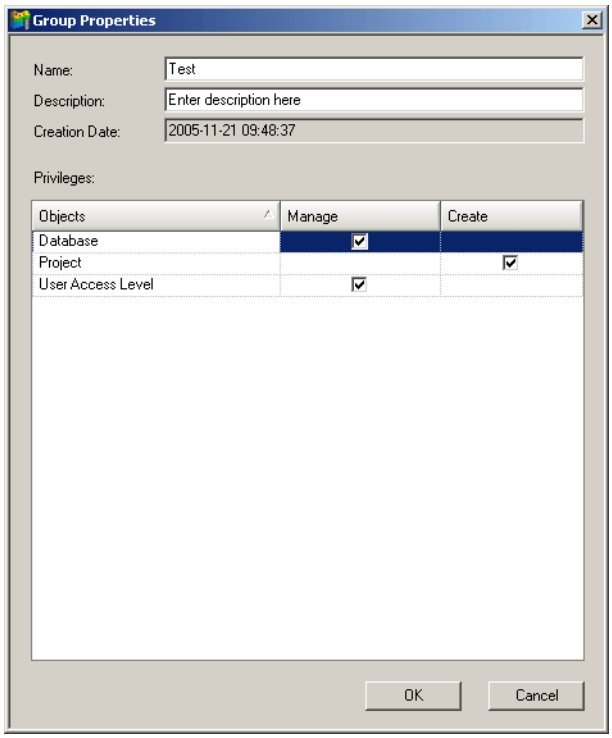
NOTE: The level of access to an object are defined on a user-group level and not for each individual user.

Application Level Objects

The Administrator may control user access to the following application level objects:

- Databases
- Projects
- User Access Level

Application Level Objects can only be modified when HGA is running, and NO project is opened. The Group Properties for Application Level Objects are shown below



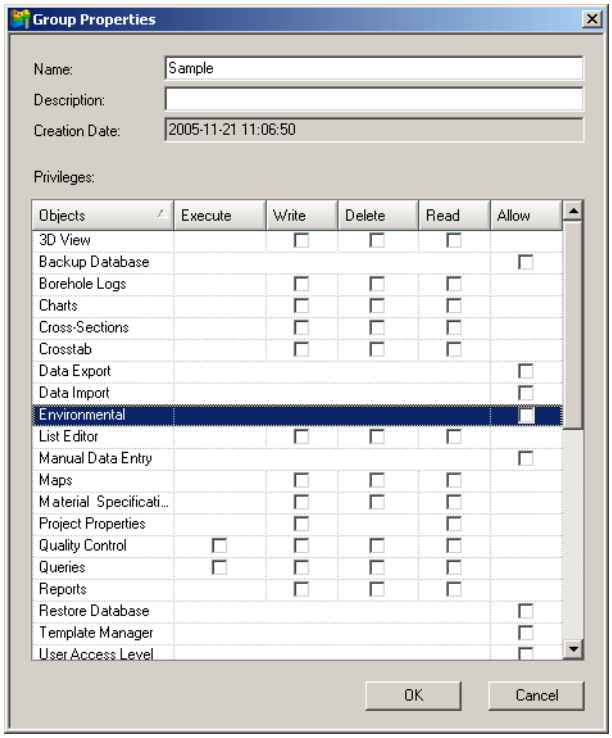
Databases: you may assign rights for Manage, which allows deleting databases and projects.

Project: you may assign rights for Creating Projects.

User Access Level: you may assign rights for Managing user access levels. Users with this privilege will be able to modify the Project Level objects, when a project is opened.

Project Level Objects

Settings for Project Level objects can only be defined when the project is opened. The Group Properties for Project Level Objects are shown below:



The administrator may control user access to the following application level objects:

Objects	**Access levels**
Backup Database Restore Database User Access Level settings Manually Add/Remove data DTS-Import Data Import Station Data DTS-Export data Template Manager Database views (Templates), e.g. Environmental template	Allow (Yes or No)
Queries Quality Control	Read, Write, Delete, and Execute

Objects	Access levels
3D-Explorer Borehole logs Charts Cross-Sections Cross-Tab Queries List Editor Map Manager Material Specifications Editor Reports	Read, Write, and Delete
Project Properties	Read and Write

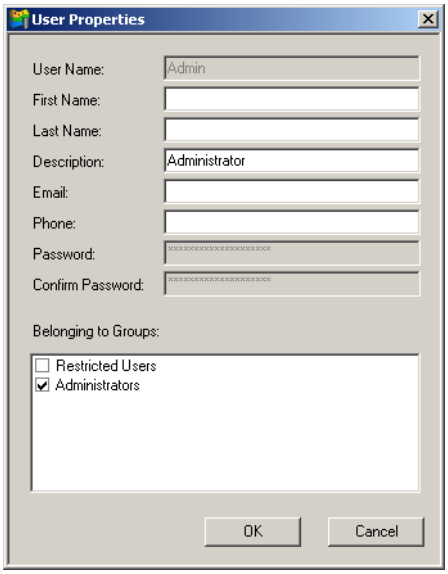
When you are finished, click **[OK]** to save the settings for the Group, and close the dialog.

4.1.5 User Properties

The UALM allows the administrator to add and edit the properties for the various Users in the project. To load these settings,

- From the main UALM window, select one user under the **Users** node in the tree view
- Click on the (Add) button to add a new User, or
- Click on the (Edit) button to edit the properties for the selected User

The following **User Properties** dialog will appear:



Define the User personal and contact information, including: **User name, First Name, Last Name, Description, EMail, Phone**, **Password,** and **Confirm Password**.

Belonging to Groups: Select the User groups to which the User should belong.

When you are finished, click **[OK]** to save the settings for the user, and close the dialog.

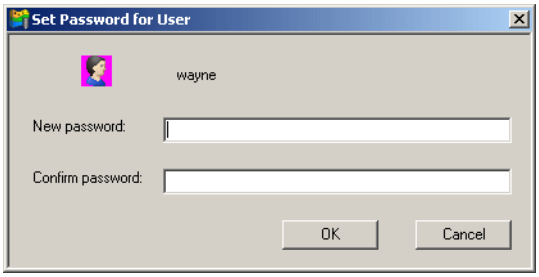
HINT: Be sure to keep your password in a safe-place, as it will be needed each time the project is accessed.

Set Passwords

The administrator may also set passwords for various users in the project. To load this setting,

- From the main UALM window, select one user under the **Users** node in the tree view
- Click on the (Set Password) button.

The following dialog will appear:



Enter the **New Password** in the first line.

Confirm the new **password** in the second line.

Click **[OK]** when you are finished, to apply the new password, and close the dialog.

NOTE: If an administrator password is lost, it cannot be retrieved. You are recommended to keep the project administrator password in a safe place, or to create multiple project administrators for multiple users for both the projects and on an application level, as a backup.

4.1.6 Exporting PLSD

Once you have defined a security document for a project (users, user groups, access rights), these are saved to the project database. These settings can be re-used in future projects, by exporting the current database template. Upon exporting, the PLSD will be saved, and will be included in new projects created with this specific database template.

For more details on exporting database templates, see Chapter 5: Exporting the current template as a Database template.

4.2 Using the Project Manager

This chapter presents information on how to create new projects, and modify the properties of existing projects. HydroGeo Analyst is designed to manage databases storing data for multiple projects. A project in HydroGeo Analyst refers to a set of data with common elements. Some of these common elements may be location, nature of the data, or the purpose for which the data is collected and stored.

A project can be created in an existing HydroGeo Analyst database in which case it will be able to share some of the available existing data. For instance if the new project is created in an existing database containing all groundwater monitoring locations in a Province/State where the project is located, the project may share all or part of the information stored in this database.

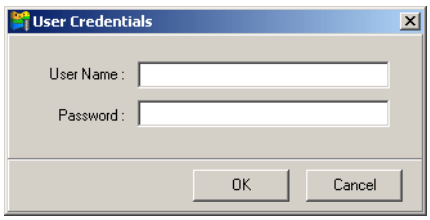
A project can also be created in a completely new database; in this case, HydroGeo Analyst provides a step-by-step **Project Wizard** that assists with the project creation process.

Loading the Project Wizard

The Project Wizard can be launched in two ways:

- Select **Project / New** from the HydroGeo Analyst Main Menu; OR
- Click on the (New) button on the HydroGeo Analyst toolbar

A prompt will appear for the User name and password, in a dialog as shown in the example below:



HGA includes a default user “Admin” with no password.

If you have modified this user, or added additional users (with permissions to create projects), then login now with the appropriate credentials.

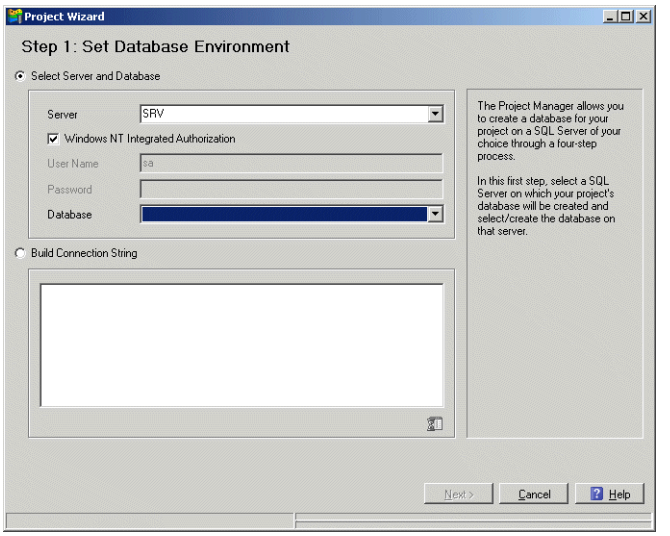
The Project Wizard will then appear. The Project Wizard contains three steps, each step appearing in a new window, with the various settings for a new project. These include:

- **Step 1: Set Database Environment**: In this window, specify the server and database to be used for the HG Analyst project, and the connection string if necessary.
- **Step 2: Create Project Dependent Tables**: Select a database structure from a list of available templates, or create a new database template.
- **Step 3: Set Project Properties, Location, and Soil Settings**: In this window, specify the project name, project folder, project location, projection system, units, and specify the SCS (soil) settings for the project.

The project wizard is designed in a sequential fashion; after defining the necessary inputs in each window, press the **[Next>]** button to proceed. The Next button will only become activated after the necessary fields have been defined. These required fields are indicated by an asterisk (*).

4.2.1 Step 1: Set Database Environment

The Set Database Environment window (shown below) is the first step in the Project Wizard, and provides the controls needed to select a MS SQL Server and create/select a database for the new project.


Project Wizard
Step 1: Set Database Environment
Select Server and Database
Server
SRV
Windows NT Integrated Authorization
User Name
sa
Password
Database
Build Connection String
The Project Manager allows you to create a database for your project on a SQL Server of your choice through a four-step process.
In this first step, select a SQL Server on which your project's database will be created and select/create the database on that server.
Next >
Cancel
Help

HydroGeo Analyst requires a MS SQL server to host the project database. A server can be any computer on your network which has MS SQL Server 2005 Express installed, or an installation of WHI-SQL Express installed. The WHI-SQL Express can be installed on your hard drive as part of the installation process. If the WHI-SQL Express is installed, it will be setup as the default database server. This will allow your local computer to act as a server for new projects. The MS SQL Server 2005 Express is a data engine built, and based, on core MS SQL Server technology.

If you are working on a stand-alone computer, then the MS SQL server would be your computer, and the server name would be the name of your computer (as it appears in your General System Properties) followed by the abbreviation “WHI”. For example, if your computer’s name is “John”, the MS SQL Server name would be John\WHI.

Once the server is selected, select from an existing database on this server, or create a new database.

HydroGeo Analyst allows you to:

(1) Select from a list of known servers and create/select a database; OR
(2) Build a Connection String to an existing database on a server

NOTE: The current version of HydroGeo Analyst supports MS SQL Server 2005 Express, MSDE and later; other SQL Servers (such as Oracle, DB2, Sybase, Terradata, etc.) are not supported. The current supported language is T-SQL,

SQL-92 standard; other dialects (such as SQL-99, PL/SQL, Watcom SQL,...) are not supported.

Any existing database which satisfies a few basic requirements can be selected for your project. These requirements mainly have to do with tables and/or fields with reserved names. For example selecting a database that has a table named “Station” will not be accepted by HydroGeo Analyst unless this table satisfies the requirements of HydroGeo Analyst’s “Station” table. The “Station” table must contain the following required fields each with a specific data type:

- ID
- Name
- X-Coordinate
- Y-Coordinate and
- Elevation (ground surface)

If this table structure exists in the database and satisfies these requirements, then it may be used to store the “Station” information.

Option 1: Select Server and Database

If the **Select Server and Database** radio button is selected, you will be prompted for a Server name and a Database name. You must specify a server in order for a database to be created. As mentioned earlier, this may be any computer located on your network (LAN), which has a MS SQL Server 2005 Express installation, or WHI SQL Express. If you do not have a network connection, only your computer name will appear in the list of servers. (e.g. Computer_Name\WHI)

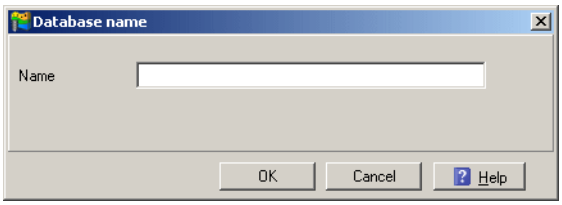
☞ Choose a server from the **Server** list at the top of the dialog. After the Server is selected, HG Analyst will automatically scan the Server for valid SQL databases. These databases will then appear in the combo box beside **Database**.

☞ If there is an integrated login for the server, check the box beside “Windows NT Integrated Authorization”. If a unique password and ID are required, de-select this option, and enter the Windows **User Name** and **Password** for the Server computer. This will allow HG Analyst to automatically log on to the Server each time you modify the database residing on the specified machine.

Note: If you cannot see your local WHI instance of SQL Express when creating a new project, or opening an existing project, please refer to 15.7: Appendix G: Frequently Asked Questions (FAQ’s) for some troubleshooting suggestions.

Next, select a Database on this Server:

☞ **Database** combo box. To create a new database, select **Create New Database** from this list. Enter a name for the database, in the window shown below, then click **[OK]**.



☞ **[Next]** button in the lower right corner of the Project Wizard window to proceed.

HydroGeo Analyst will then test the connection to the server, and scan the database to see if the required tables exist in this file. For new databases, HG Analyst will create the required tables. Please be patient during this process.

NOTE: When using SQL Express, the database will be created in the default directory:

\Program Files\Microsoft SQL Server\MSSQL$WHI\Data\,

with the file extension ".mdf". Be cautious when un-installing SQL Express, as this may result in the loss of your data.

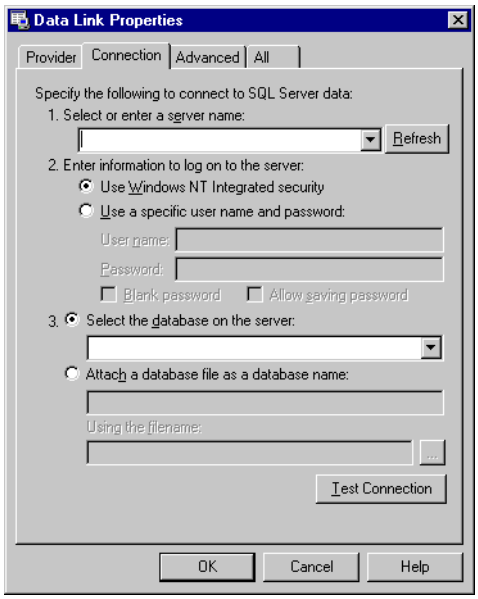
If the server connection and database are valid, the next window in the Project Wizard will be displayed. Otherwise, there will be a warning notification regarding the server or database. If this is the case, please select another server or database for your project, or verify whether the connection exists.

Option 2: Build Connection String

If the **Build Connection String** radio button is selected in the **Database Environment** window, there will be an option to locate an MS SQL Server, and build a connection to a database on a network server.

☞ **Build Connection String** radio button from the **Database Environment** window.

☞ (Build connection string) button (located in the lower right corner) and the following **Data Link Properties** dialog will appear:



The **Data Link Properties** dialog box is the standard Windows system interface for configuring connection strings to data sources. This dialog box provides all of the properties that the selected OLE DB provider supports. You also can open this dialog box by double-clicking a universal data link (.udl) file in Windows Explorer.

The Data Link Properties dialog box contains four tabs: **Provider, Connection, Advanced,** and **All**. The settings available on the latter three tabs depend upon the **Provider** selected.

The **Provider** tab of the Data Link Properties dialog box is used to select the appropriate OLE DB provider for the type of data you want to access.

NOTE: HG Analyst currently supports only a Microsoft OLE DB provider for MS SQL Server, as specified in the **Provider** tab.

Use the **Connection** tab of the Data Link Properties dialog box to specify where your data is located and how to connect to it using an OLE DB provider. The connection information can be represented using a common string format.

Note that the fields displayed on this tab depend upon the OLE DB Provider selected. For example, if you select the OLE DB Provider for Oracle, the Connection tab displays fields for the server name and login. If you select the OLE DB Provider for SQL Server, then the server name, type of authentication, and database must be entered.

In the **Connection** tab, there will be options to specify the server and database settings.

☞ 1. **Select or enter a server name**. Choose a server from the Server list at the top of the dialog. The list will display all computers on the LAN that

have MS SQL Server 2005 Express support. If the current machine is not networked, then the list will display the name for the current computer, provided the WHI SQL Express instance is installed.

☞ 2. **Enter information to log on to the server**. If the selected server requires security validation, enter the windows login information, (user name and password).

☞ 3. **Select the database on the server**. If it is preferred to create a new database, then leave this field blank.

☞ 4. Press the **[Test Connection]** button in the lower corner of this dialog, to ensure that a valid connection to this Server exists.

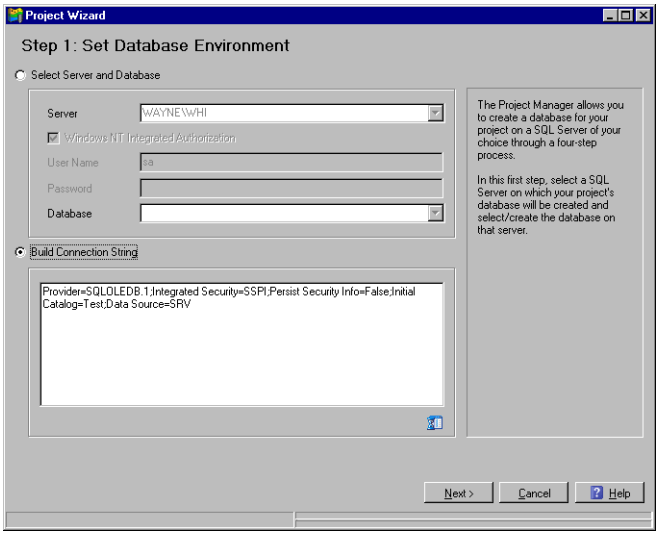
The additional tabs in the Data Link Properties window include:

Advanced: includes default network settings.

All: view and edit all OLE DB initialization properties available for the OLE DB provider. Properties can vary depending on the selected OLE DB provider.

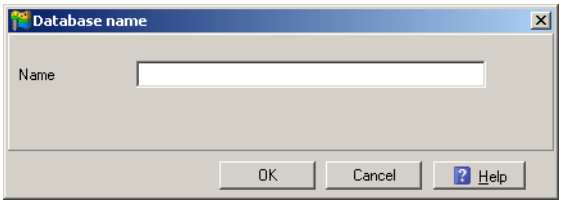
For more details, press the **[Help]** button in the Data Link Properties dialog, to view an on-line help for this component.

☞ Click **[OK]** once the Data Link settings have been defined to return to the Project Wizard. The Connection String will now appear in the Database Environment window. An example is shown below:


Project Wizard
Step 1: Set Database Environment
Select Server and Database
Server
WAYNE\WHI
Windows NT Integrated Authorization
User Name
sa
Password
Database
Build Connection String
Provider=SQLOLEDB.1;Integrated Security=SSPI;Persist Security Info=False;Initial Catalog=Test;Data Source=SRV
The Project Manager allows you to create a database for your project on a SQL Server of your choice through a four-step process.
In this first step, select a SQL Server on which your project's database will be created and select/create the database on that server.
Next >
Cancel
Help

☞ **[Next]** to proceed.

HG Analyst will then test the connection to the server. If a database was selected in the **Data Link Properties**, then HG Analyst will scan and validate the database to see if the required tables exist. If no database was selected, then there will be a prompt to define a name for the new database, as shown below:



type: Name of the new database

☞ **[OK]**

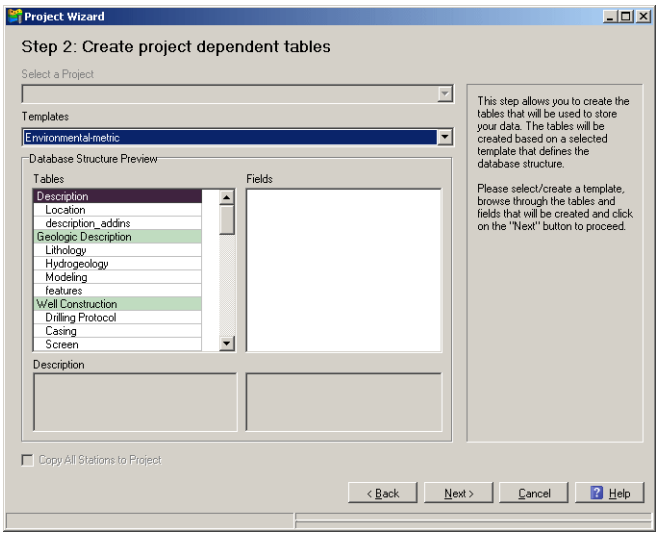
For new databases, HG Analyst will create the required tables. Please be patient during this process.

If the server connection and database are valid, the next window in the Project Wizard will be displayed. Otherwise, there will be a warning notification regarding the server or database. If this is the case, please select another server or database for your project, or verify the connection to the selected server.

The next step is to select or create the **Database Template** for the project.

4.2.2 Step 2: Create Project Dependent Tables

The next window in the Project wizard contains the Database Structure settings. This includes tables, fields, and relationships. In this window, choose from one of the existing database templates, or create a new one, as shown in the figure below:



Selecting the Database Template for your project

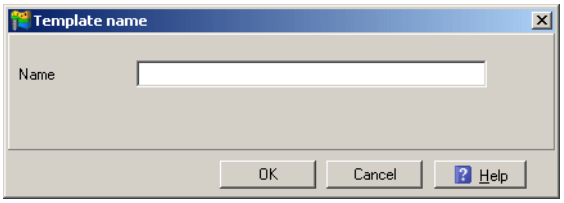
In this window, you may select from a pre-defined Database structure, or create a new database structure for the project. For your convenience, there are several Database structures included with HGA, which include the necessary tables for storing and managing environmental data. These include:

- WHI's own Environmental Database Template (designed for groundwater data management, expands U.S. EPA Regions 2 & 5 standards),
- Ontario's Ministry of Environment's (MOE) Water Well Information System (WWIS) Template (designed for management of water well records), and
- U.S EPA Regions 2 & 5 Environmental Data Models (designed for environmental data management

All templates are available in both metric and imperial length units.

In most cases, one of these database structures should be adequate for your projects. If not, you may use the **Create New Template** option to create a new structure, containing only the Stations table. Then, after the project is created, you may use the Template Manager, to create and define the required tables and fields for your project. For more details on this feature, see Chapter 5: Creating a new template.

If you select to Create a new template, a prompt will appear for a name for the new template.



The template will be created, and will contain only the required table for an HG Analyst database. This is the Station Table, with the following fields:

- Name
- ID
- X Coordinate
- Y Coordinate
- Elevation
- TOC (Top of Casing)

If you select one of the existing Database structures, you will see a list of the tables included with this template, and the corresponding fields, under the **Database Structure Preview**. Take a few moments to review this database structure.

☞ **[Next]** to create the project tables, and proceed to the next step in the wizard.

Creating Projects in Existing Databases

At the top of this window, there is a list of Projects in the selected Database. This option is only available if an existing database was selected in Step 1. If so, you may choose from the available HydroGeo Analyst projects on this database, and select a database template from an existing project. If a NEW database was created in Step 1, the projects picklist will be inactive.

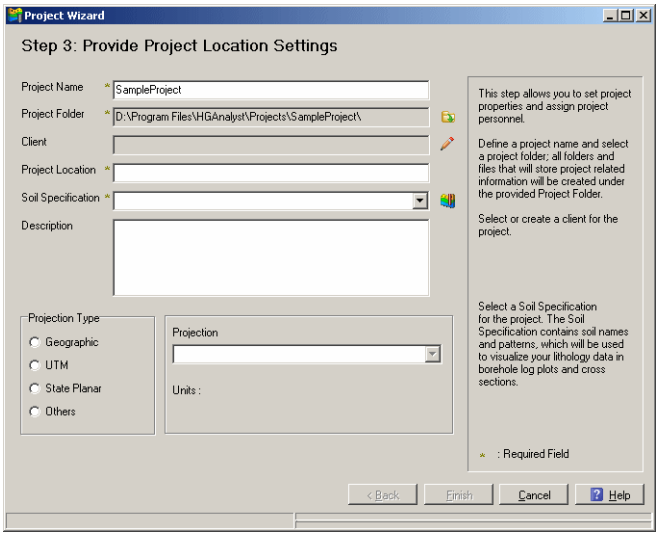
☞ **[Next]** to create the project tables, and proceed to the next step in the wizard.

The database settings may be modified AFTER the project has been created, using the Template Manager. For more details, please see Chapter 5: Template Manager.

The next step is to define the Project Properties and Location settings.

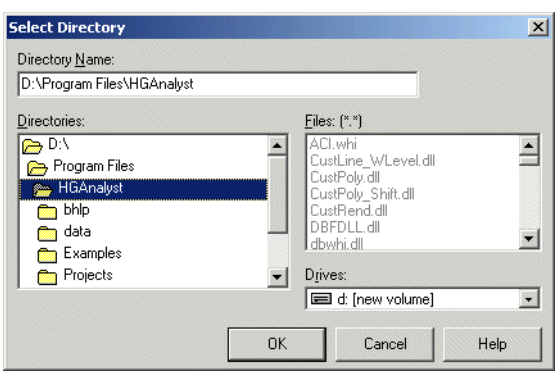
4.2.3 Step 3: Set Project Properties and Location

The Set Project Properties and Location window, (as shown below) contains general project information, such as project name, folder, location, and soil settings:


Project Wizard
Step 3: Provide Project Location Settings
Project Name
SampleProject
Project Folder
D:\Program Files\HGAnalyst\Projects\SampleProject\
Client
Project Location
Soil Specification
Description
Projection Type
Geographic
UTM
State Planar
Others
Projection
Units :
This step allows you to set project properties and assign project personnel.
Define a project name and select a project folder; all folders and files that will store project related information will be created under the provided Project Folder.
Select or create a client for the project.
Select a Soil Specification for the project. The Soil Specification contains soil names and patterns, which will be used to visualize your lithology data in borehole log plots and cross sections.
: Required Field
< Back
Finish
Cancel
Help

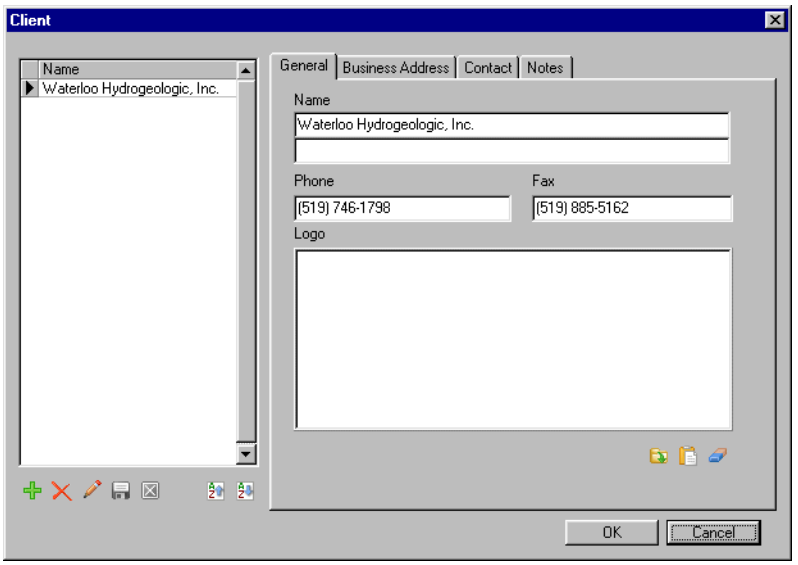
In the first line, enter a project name. This may be any combination of numbers and letters, but should not contain spaces (use _ or - to substitute for spaces). The project name will be used to define the HG Analyst project folder. As the name is entered, an identical folder name will be created, and will appear in the **Project Folder** field.

You may modify the project directory, by clicking the folder button , and the following dialog will appear:



Select a new directory, then click **[OK]** to continue.

The next step is to define the Client for the project. (Client information is not a required field for new projects). The Client information is selected from a list saved in the current database; to select a client from the list, press the (Edit) button to load the Client List dialog:



In this window, define the client applicable to the project. A list of clients may be defined in this window, for use in future projects. Follow the steps below:

☞ (Add) button (in the lower left corner) to add a new client

For each Client name, enter the Company name, address, and contact info. A logo may also be defined for each client. Once this is complete,

☞ (Save) button to save changes to a client

☞ **[OK]** to load the selected client into the project manager for this project.

Other functions in the **Client** window are summarized below:

- Use the button to remove the selected client from the list
- Use the button to edit the selected client
- Use the button to undo the edits for the selected client

Under the **Logo** frame,

- Use the button to load a new graphics for the logo
- Use the button to paste a file from the clipboard for the logo
- Use the button to remove the selected logo file

Once back in the Project Wizard, the next step is to define the project location and projection system.

In the next line, enter your **Project Location** and specify the **Soil Classification Settings** (SCS). The soil classifications will be used to represent soil materials in the cross sections and borehole plots in the program. One of the existing SCS's may be selected, or a new SCS may be easily created. The available soil settings include:

- USCS (Unified Soil Classification System)
- USDA (United States Department of Agriculture)
- DIN 4023 (Deutsches Institut für Normung e.V.)
- IAH (International Association of Hydrogeologists)
- Compton

Simply choose the desired soil settings from the combo box. To customize or create a soil classification, press the button to load the **Material Specification Editor**. For more details on customizing the soil settings, please refer to Chapter 3: Material Specifications Editor.

You may also enter a **Description** of the project in the field below the Soil Specifications (optional).

Finally, under the **Projection Type** frame you must specify the coordinate system used for this project. You may choose from the following list:

- Geographic
- UTM
- State Planar
- Others

Once the projection **Type** is selected, choose the **Projection** from the combo box on the right side of the window. The **Units** will be selected automatically, based on the selected projection type (e.g. UTM will use m, State Planer will use feet, etc.)

Once you have specified the required settings, you will see that the **[Finish]** button at the bottom of the window will become active. This indicates that you have entered the necessary input fields for a new project, and you can finish the Project Wizard, and create your new project.

☞ **[Finish]** to create the project and close the Project Wizard.

A new project will be created, with the necessary tables, fields, and settings. Please be patient during this process. The new project should then appear in the main HGA window.

The first time the project loads, the settings for User Access Management will be presented. As the creator of the new project, you will have Administrator rights, where you can add/remove users, and assign access rights. For more details on this feature, please see “User Access Level Management” on page 157.

You may return to the Project Manager settings window at any time, if you need to modify any of the project settings defined above. To do so, select **Project / Properties** from the main menu of HydroGeo Analyst. This is explained in the following section.

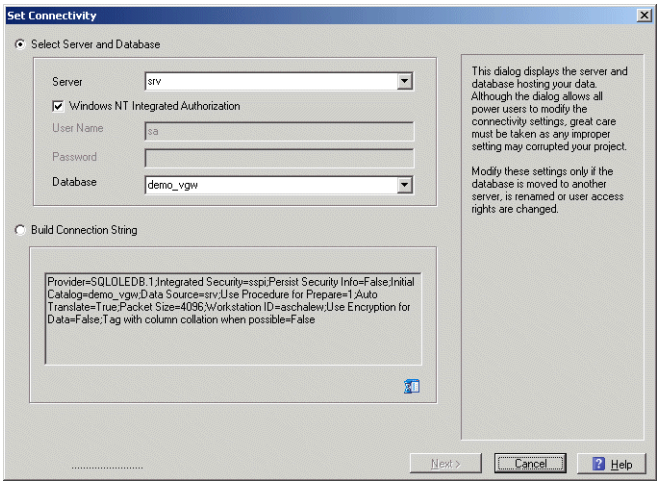
4.2.4 Modifying Project Properties

Once a project is created, there are certain settings and properties that may be modified; some critical settings may be available as read-only.

To view the project properties, select **Project / Properties** from the main menu of HydroGeo Analyst. In this menu, there are two options: **Connectivity** and **Miscellaneous Settings**.

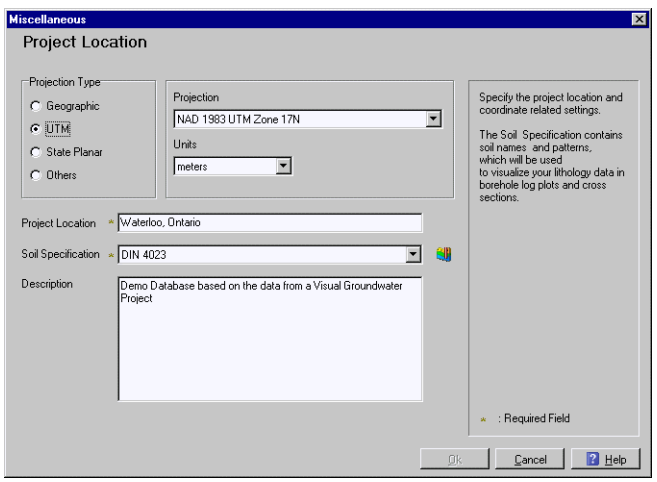
Connectivity

This option allows you to check the database connection settings for the current project. If the connection is lost, or the server is modified, the connectivity settings can be redefined in the dialog shown below.


Set Connectivity
Select Server and Database
Server
srv
Windows NT Integrated Authorization
User Name
sa
Password
Database
demo_vgw
Build Connection String
Provider=SQLOLEDB.1;Integrated Security=sspi;Persist Security Info=False;Initial Catalog=demo_vgw;Data Source=srv;Use Procedure for Prepare=1;Auto Translate=True;Packet Size=4096;Workstation ID=aschalew;Use Encryption for Data=False;Tag with column collation when possible=False
This dialog displays the server and database hosting your data. Although the dialog allows all power users to modify the connectivity settings, great care must be taken as any improper setting may corrupted your project.
Modify these settings only if the database is moved to another server, is renamed or user access rights are changed.
Next >
Cancel
Help

Miscellaneous Settings

This dialog provides access to project coordinates and soil classification system.



If the projection system is changed, existing station coordinates will be converted into the new projection system.

If the Soil Classifications System is changed, existing cross sections with defined geology will be impacted. It may be necessary to reassign geological soil types with the new soil classification system, and recreate the cross sections.

5

Template Manager

The Template Manager is one of the most powerful tools provided with HydroGeo Analyst. It allows you to edit the structure of your database as well as set an unlimited number of user-level views of the database. The Template Manager provides the tools to:

- Add/delete tables
- Add/delete fields
- Alter the properties of each table/field
- Group tables under logical data categories
- Edit table designs (define primary keys, relationships between tables, etc.)
- Save user templates
- Export user templates to a stand-alone XML file
- Create and edit linked fields
- Set any selected user template as the default template for all new users;
- Set visibility of tables and/or fields
- Setting user level table and/or field names, display units (where applicable), and data formats (where applicable)

5.1 Understanding the Template Manager

HydroGeo Analyst comes with a number of standard environmental database structure templates that are currently in use around the world. When creating a new database for your project, you have the option of either using one of these database templates, or creating your own. If the latter is selected, the template manager can be used to create the new database structure from scratch.

All database structure templates that come with HG Analyst also come with their respective report and borehole log plot (BHLP) templates. As such, if one of the existing database templates is selected during the project creation, these templates will be copied to your project by default. You can later edit them or even remove them from your project if desired.

The Template Manager allows you to modify the current user view, as well as create an

unlimited number of additional user views. For example, a geologist working on the project may only need to view tables that are related to geological investigation data. The Template Manager allows you to hide all unwanted tables and/or fields from such users and display only a smaller set of relevant tables and/or fields.

All user modifications to the database views can be saved either in the currently active template, or as a new name. All such modifications to the project's database are automatically reflected in all copies of user settings. The Template Manager allows you to export the currently active database structure as a new database structure, for use in creating similar projects.

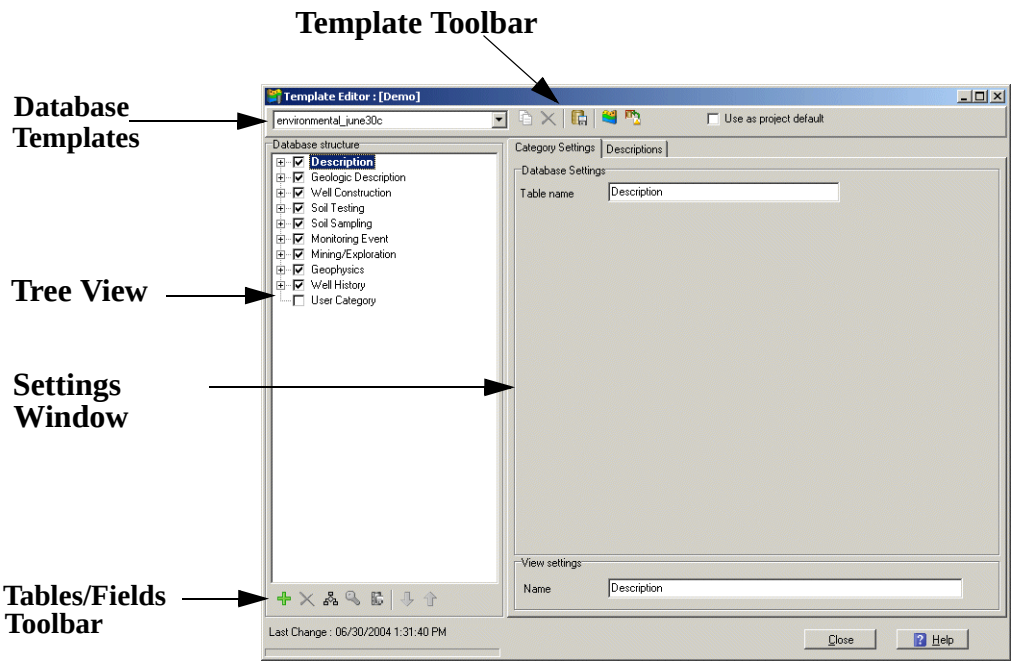
More information on the detailed options that are available in the Template Manager is provided later in this chapter.

5.2 About the Interface

The Template Manager may be loaded from HydroGeo Analyst in several ways:

- Select **Settings / Template Manager** from the Main Menu;
- Click on the (Template Manager) button from the toolbar.

The Template Manager window is shown in the figure below:



The Template Manager window contains the following items:

- The **Template Toolbar**: Contains toolbar buttons that affect templates as a whole
- The **Database Templates**: Contains a list of the available database templates.
- The **Tree View**: Contains a view of all data categories, tables, and fields for the selected template.
- The **Settings Window:** Contains the interface for editing tables and fields.
- The **Tables/Fields Toolbar**: Contains toolbar buttons that affect the selected field or table.

5.2.1 Description of Toolbar Items

The Template Manager provides two groups of toolbar items:

- The **Template Toolbar (Upper Toolbar)**: consists of buttons that affect database templates as a whole.
- The **Tables/Fields Toolbar (Lower Toolbar)**: consists of buttons that affect the selected field / table, in the selected template.

Template Toolbar: Global Template Options

The buttons on the upper toolbar (located at the top of the window, immediately beside the list of Database templates) contains buttons that allow copying an existing template, saving changes made to the current template, exporting the current template as a database structure template, and deleting the current template. The functions of the buttons are described below.

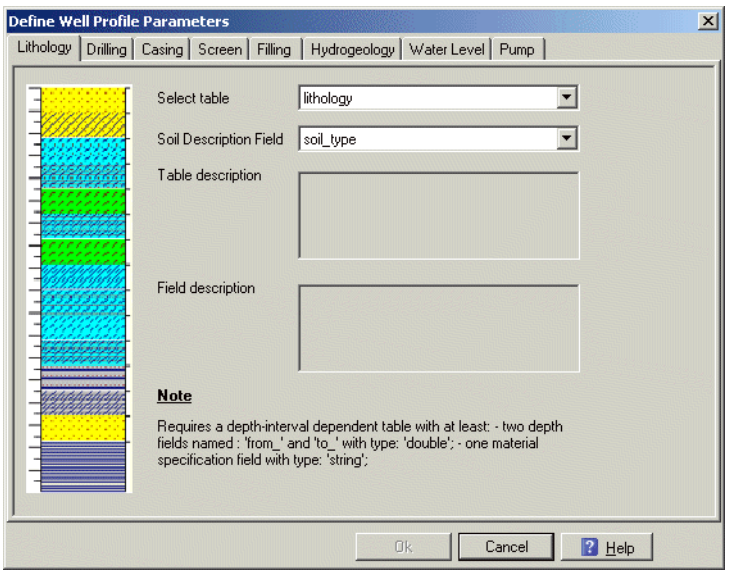
The **Copy Template As...** button allows you to make a copy of the selected template. Clicking on this button displays a dialog where a name for the new user template can be entered.

The **Delete Template** button removes the current template from the collection of templates available for the project, and loads the default template in its place.

The **Save Template** button saves all changes made to the current user template.

Profile Settings

The **Set Profile Settings** button allows you to provide information that will be used for displaying well profiles (BHLP) in HydroGeo Analyst, as well as the Map Manager and the Cross Section Editor. Clicking on this button launches the window shown below, that can be used to specify which tables and fields are to be used to obtain information related to geology and well construction details.



This window contains several tabs:

- Lithology
- Drilling
- Casing
- Screen
- Filling
- Hydrogeology
- Water Levels
- Pump

For each category, provide the table and the field that stores the patterns to be used in all the graphical displays. For example, in the **Lithology** tab, select a table which contains the Lithology information for your project; then select a field from this table which contains the Soil Description information. The information provided in this window will be used when displaying profile diagrams in HydroGeo Analyst. The

geological data and the corresponding patterns will also be displayed in the cross section editor, and in the 3D Explorer.

Only tables with the following parameters can be displayed in this dialog:

Lithology: Tables must have two fields with type DOUBLE (from_, to_) and one field with type STRING (soil_type)

Drilling: Tables must have three fields with type DOUBLE: (from_, to_, diam_), and one field with type STRING (method)

Casing: Tables must have three fields with type DOUBLE (from_, to_, diam_) and one field with type STRING (ex. material)

If it's desired to have multiple well casings, or nested piezometers, you must also define two additional fields:

- **Casing ID**: field type LONG (used to distinguish different well casings)
- **Parent ID**: field type LONG (required only if a well casing exists within a parent casing; if so, for the selected well casing, set the ParentID equal to the CasingID of the parent casing)

Screen: Tables must have three fields with type DOUBLE (from_, to_, diam_) and one field with type STRING (ex. material)

If you have multiple well casings, you must add an additional field:

- **CasingID:** field type LONG (used to distinguish different well casings). This allows to assign multiple screens to multiple well casings.

Filling: Tables must have two fields with type DOUBLE (from_, to_) and one field with type STRING (ex. material)

Hydrogeology: Tables must have two fields with type DOUBLE (from_, to_) and one field with type STRING (ex. formation name)

Water Level: Tables must have one fields with type DOUBLE (depth_) and one field with type STRING (ex. comments). In the Water Level tab, you may also select the reference datum for measuring depth to water levels: select "Ground Surface Elevation, or Top of Casing"

Pump: Tables must have two fields with type DOUBLE (from_, to_) - two time fields named: 'start_' and 'end_' with type: 'DATE/TIME stamp'; - one description field with type: 'STRING' (ex. comments);

NOTE: The depth-point and depth-interval information (from, to fields) are depths and not elevations. As such, the BHLP and Cross Section editor require that data be entered as "depth to" and not an elevation above sea level or a benchmark.

The **Save as DB Template** button allows you to save all changes made to a new user template. A separate dialog will be displayed where the name for the template will be provided.

The **Use as Project Default** option allows you to set this template as the default when the project is opened.

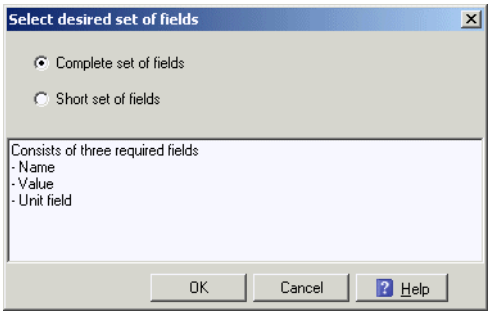
Tables and Fields Toolbar

A second toolbar is provided below the “Database Browser” (Tree View). The items on this toolbar allow manipulating the database through the “Database Browser”. A description of each of the items on this toolbar is given below.

The **Add** button allows adding tables and fields to the database depending on which node in the “Database Browser” is currently selected. For example, if a data category is active at the time this button is selected, a table will be added in that data category. Similarly, if a table is active when the “Add” button is selected, then another table will be added to the same category. A field will be added if this button is pressed while any field in the desired table is active. Both tables and fields are added at the end of the list. By default, the Template Manager names the new table/field as “type_##”/ “fld_##” where “##” stands for a number generated for the added item.
When a new table is created, press the **Add** button again (while the table is receiving the focus) to add the first field to the table.

The **Delete** button allows deleting the selected node. This button is activated when either a table or a field is currently selected. Data categories, as well as some required tables (e.g. the Station table) and fields (e.g. required fields ID, X, Y, Elevation, etc.), may not be deleted.

The **Add Linked Fields** button is activated whenever a field is selected in the “Database Browser”. If this option is selected, the dialog shown below will be displayed requesting the user to provide the fields that should be linked.

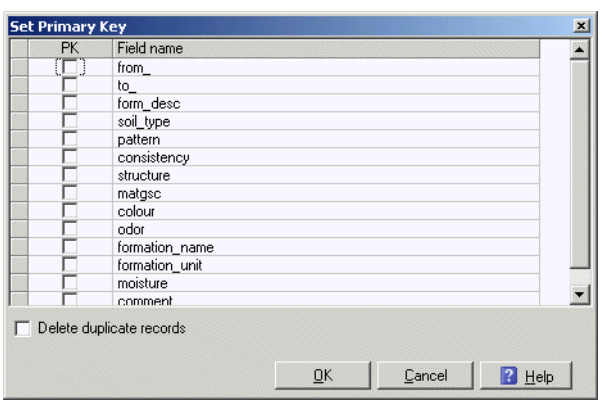


The concept of linked fields is introduced in HydroGeo Analyst in order to enhance data integrity. If two or three fields are linked together, HydroGeo Analyst tracks changes made to values under one field, and makes appropriate changes to all other linked fields as appropriate. Currently, a maximum of three fields can be linked together.

Linking three fields may be useful in storing data such as chemistry results, (e.g. chemical names, result values, and result units). If such fields are linked, you may change the result unit for any record and automatically see the result converted to the new unit. This avoids the problem of changing result units without converting the result values to the appropriate unit.

At times it may be necessary to link only two fields. For example when storing depth related data with variable units, an additional field to store the unit for each record is required. In those circumstances the two fields can be created as linked fields enhancing data integrity.

The **Set Primary Key** button is activated only when a table is active and receiving the focus. It allows defining the primary key for the table. If selected a separate dialog (as shown below) will be displayed, where one or more fields can be selected to form the primary key for the table.



The **Apply Changes** button allows you to save all changes made to the current user template.

The **Move Down** button moves any selected table or field one level down in the Database Browser (tree view). Tables and fields will be displayed in HydroGeo Analyst in the order they are shown in the database browser.

The **Move Up** button moves any selected table or field one level up in the Database Browser (tree view). Tables and fields will be displayed in HydroGeo Analyst in the order they are shown in the Database Browser.

5.3 Working With the Template Manager

5.3.1 Modifying Tables and View Settings

The Template Manager displays all user tables under their logical categories. Information on categories, as well as tables and fields, can be displayed by clicking on the desired item. A description of the interface that is provided to view or edit these items is provided in the following sections.

Data Categories

As mentioned earlier in this document, a fixed number of data categories are provided in HydroGeo Analyst in order to help group similar information. There are nine pre-defined categories, and one user-defined category. The categories are created based on those groups that are common in environmental data management systems. These categories include:

- Description (information related to site and stations)
- Geologic Description (information related to subsurface geology)
- Well Construction (information related to drilling methods, casing, filling, etc.)
- Soil Testing (information related to geological investigations such as penetrometer tests)
- Soil Sampling (information related to soil investigations such as soil vapor, coring, etc.)
- Monitoring Events (sampling for chemical information, as well as water levels and any other data resulting from monitoring events)
- Geophysics (resistivity and gamma readings)
- Well History (historical information on wells)
- Mining/Exploration (results from any mining and exploration activities)

- User Category

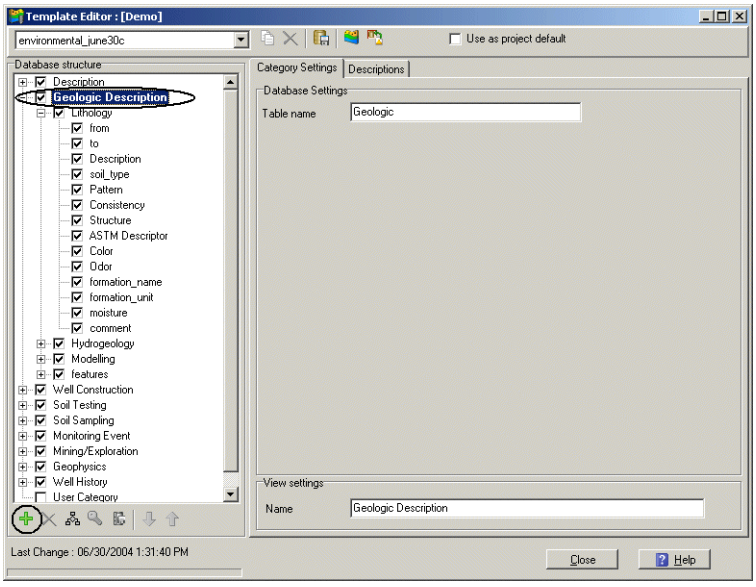
Any of these categories can be renamed as desired and used to store any information. Selecting a category in the Template Manager displays an interface where the name of the category can be renamed, both in the database as well as in the template (view) settings.

Table Property Settings

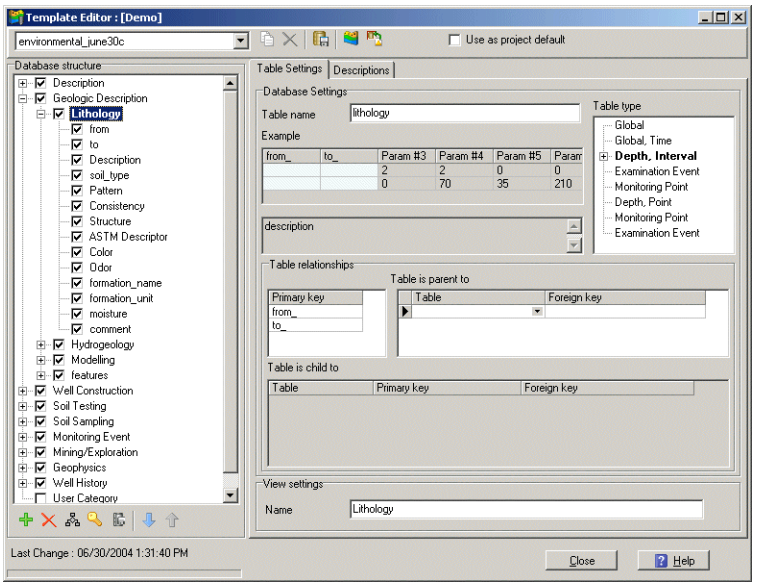
Information related to all user tables can be edited through the Template Manager. The Template Manager allows all users to set the visibility status of any selected table. To make a table visible or hidden, check or un-check the tick boxes that are provided in front of the table name, in the Project Browser.

Adding Tables

A table can be added by selecting a data category in which the table is to be created, and then either by clicking on the (Add) button at the bottom of the window, or by right mouse clicking, and selecting the “Add table” pop-up menu item.



A table can be created based on any one of the provided data (table) types, depending on the nature of the data to be stored in the table.



Based on the nature of environmental data and the purpose for which the data is collected, there are generally eight table types (as shown in the following table).

No.	Setting, Discretization	Purpose	Required Fields
1	Global	General	ID
2	Global, Time	Monitoring Events	Date and Time
3	Depth, Interval	Sample collection	Start Depth, End Depth
4	Depth, Point	Sample collection	Depth
5	Depth, Interval, Time	Monitoring events	Monitoring Point ID Start Depth, End Depth Date, Time
6	Depth, Interval, Time	Exploration events	Examination Point ID Start Depth, End Depth Date, Time

No.	Setting, Discretization	Purpose	Required Fields
7	Depth, Point, Time	Monitoring events	Monitoring Point ID Start Depth, End Depth Date, Time
8	Depth, Point, Time	Exploration events	Examination Point ID Start Depth, End Depth Date, Time

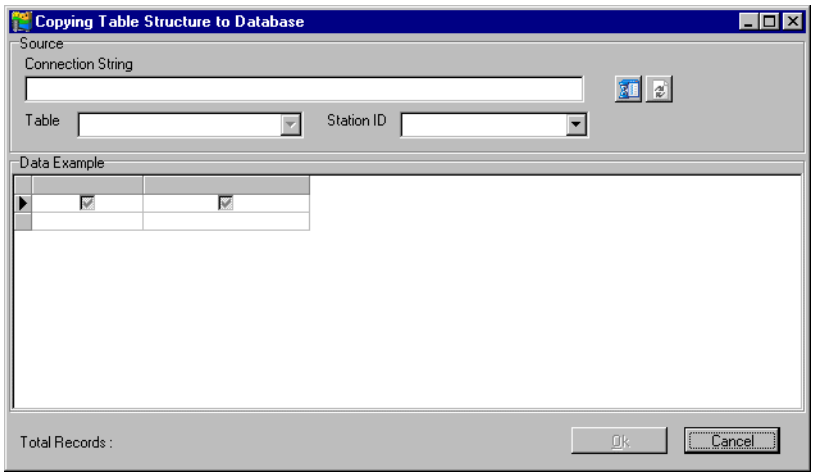
NOTE: The depth-point and depth-interval information (from, to fields) are depths and not elevations. As such, the BHLP and Cross Section editor require that data be entered as “depth to” and not an elevation above sea level or a benchmark.

The Table Types are listed on the right side of the Table Settings window. When the desired Table type is selected from this frame, HydroGeo Analyst lists some of the most commonly used tables, wherever applicable, as Example tables. For example, if a depth-interval data type is selected, tables such as Lithology, well drilling, well casing, etc. will be listed in the “Example tables”. Select a sample table to view the structure, including the required fields colored in blue. Selecting any one of the sample tables and clicking on the “Save” button at the bottom creates the table with all the required fields.

After a table is added, as many fields as desired can be added to the table. In addition, all settings such as defining or refining the primary key and relationship to other tables can be undertaken.

Importing Tables

A new table can also be created based on a table structure read from any OLE-DB supported database. To import a table source structure, right-click on a data category, select the “Import table structure” option from the pop-up menu, and the following window will appear.



- Click on the button to build a connection string to an existing database or file. The Data Link properties dialog will be displayed. For assistance on using the Data Link Properties, please see Appendix C: Using the Data Link Properties for Importing.
- Once the data source is selected, click on the Refresh button.
- Select the **Table** from this database, and the field which should be used as the **StationID**, from the respective picklists. A preview will appear in the lower half of the window.
- Click **[OK]** to begin the import.

The Template Manager creates the new table by importing all fields and their settings into HydroGeo Analyst. The created table will have the “General” structure. The Template manager does not attempt to capture primary key settings, so this must be defined after the table and its fields are imported. In addition, as with any table, the user has the option to modify the properties of the table. All newly imported tables automatically become child tables to the Stations table.

Deleting Tables

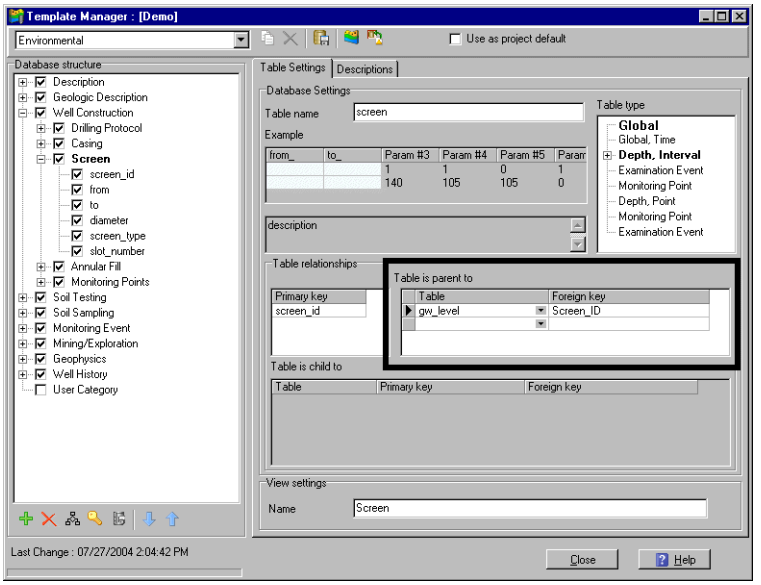
A table can be deleted by selecting it from the project browser, and then either by clicking on the (Delete) button at the bottom of the window, or by right-clicking, and selecting the “Delete table” pop-up menu item.

NOTE: The stations table is required in all projects, and may not be deleted. However, it is possible to modify some of the fields in this table, with the exception of the station ID, name, and X,Y co-ordinates.

Defining Table Relationships

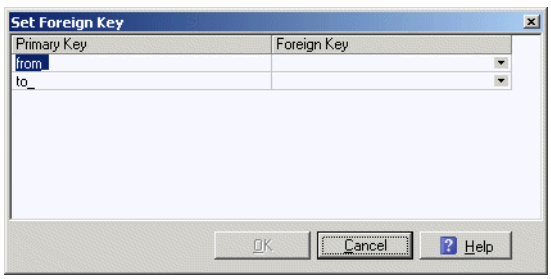
Once the primary key is set for the selected table, a relationship between the current

table and other tables in the database can be established. To create relationships, in the "**Table is PARENT to...**" grid, select one or more tables to which the current table would be a parent table. Then for each table, select one or more fields that will serve as a **Foreign key** in each table. An example is shown below.



The number of fields that need to be selected as a foreign key depends on the number of fields making up the primary key in the current table. In tables where the primary key consists of only one field, the cell where foreign keys are to be entered displays a combo box with the list of all fields in the selected table that have similar properties to the primary key in the current table. Only one field from the list can be selected as a foreign key.

In cases where the primary key is composed of two or more fields, a button is shown in the cell where the foreign key is to be entered and clicking on this button launches a separate dialog similar to the one given below.

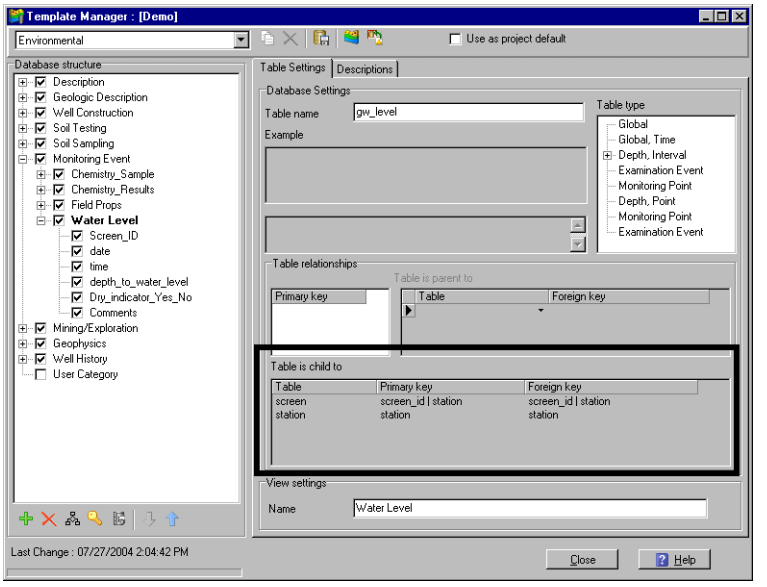


In the above dialog, a matching field must be provided for each field in the primary key

of the current table. The selected matching fields will form a foreign key in the child table.

When entering data into child tables, HydroGeo Analyst limits the values for the fields in the foreign key to only those that are present in the primary key of the parent table. This is done by using the distinct list of values in the primary key as a pick list.

All parent tables to the current table, if any, are listed along with the primary and corresponding foreign keys, in the read-only grid "**Table is CHILD to...**" located towards the bottom of the main window. An example is shown below.

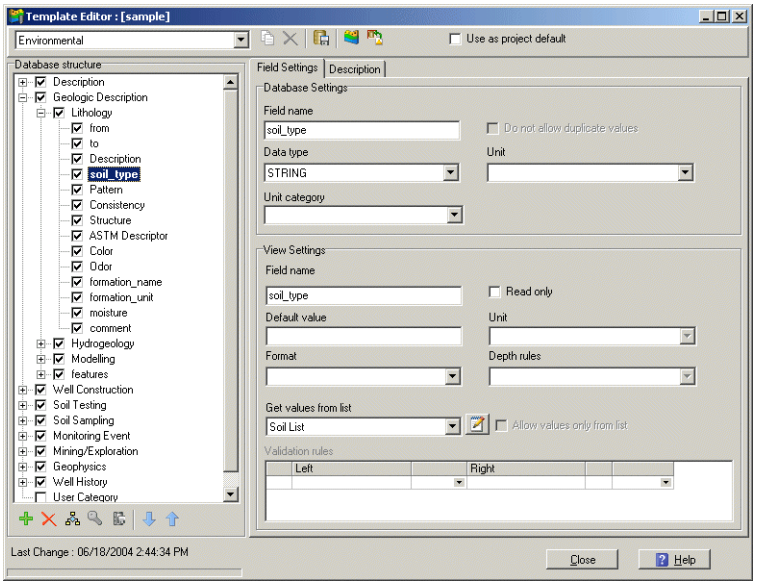


In this example, the Water Level table is child to the screen and station tables.

NOTE: The Template Manager does not allow changing the units for a primary key field. If this is necessary, you must first break the table relationship.

5.3.2 Modifying Fields and View Settings

For any selected table, the Template Manager provides the necessary interface to specify the field properties. An interface similar to that shown below is displayed whenever a field is selected in the "database browser".



The “Database Settings” section of the interface allows all users to define:

- Field name (this name will be used only for identification in the SQL Server database)
- Data type
- Unit Category (applicable for “Double” data types only)
- Units (applicable for “Double” data types only)

The following field types are available:

- Long: Field must contain an integer value
- String: Text or numbers, use for descriptive items
- Double: Real numbers, used for storing measured values (such as measurements or concentrations)
- Bit: Field contains a tick box.
- Image: Field can be used to store a raster image
- DataStamp: Field contains date value
- TimeStamp: Field contains a time value
- DateTimeStamp: Field contains a date and time value

The “View Settings” section of the interface allows all users to define:

- A name for the selected field
- A Default value
- Data display format
- Unit for data entry whenever applicable
- Validation (Depth) rules
- A list of values to be used for the field.

The name for the field provided in the View Settings is the one that will be displayed in HydroGeo Analyst. Whenever the field's data type allows, a unit for data entry can be set to something different from that which is in the database. For instance, if a well depth is set to use the British Imperial system of units (e.g. feet) in the database, and the new data to be entered is in the metric unit system (e.g. meters), the unit in the "View Settings" section can be set to be in the metric system. All data entered in this system will be converted to the appropriate unit system used in the database.

The Template Manager also allows providing validation rules for the selected field. If provided, these rules will be used to protect the user from entering erroneous data into the database. In HydroGeo Analyst, all data that does not comply with these rules is highlighted with a yellow background.

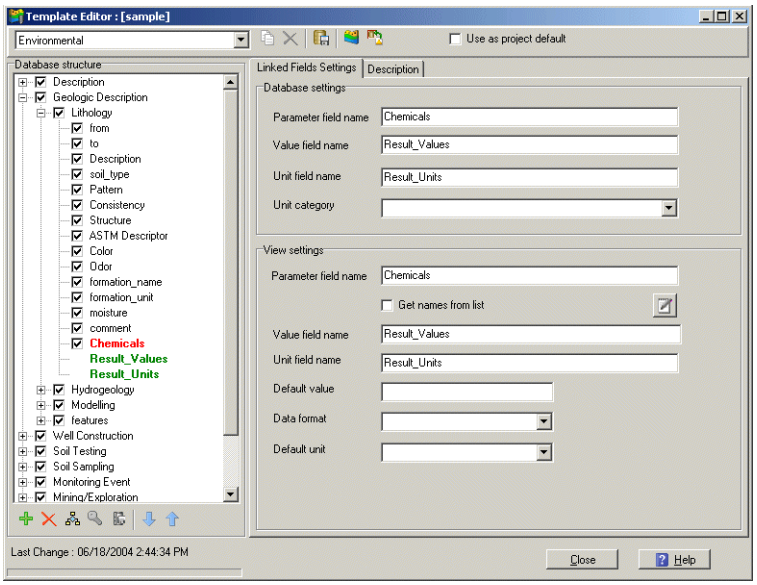
In some cases, it may be convenient to pre-define a list of values for some fields. For example, instead of typing chemical names for each record, you may want to pick from a pre-defined list. In order to link to a field's data source to a list:

- Select the "**General list**" option from the "**Get values from list**" combo box;
- Click on the "**Edit List**" button. This will display the "**List Editor**". The List Editor provides the tools for populating a list of potential values for the selected field. For more details, please see Chapter 3: List Editor.
- Select the "**Allow values only from list**" option to strictly limit the values for the selected field to those in the list. If this option is not selected, then it will be possible to either pick a value from a list or manually enter a new one, for this field.

NOTE: Recall that if a field is defined as a foreign key, a pick list will automatically be created for it based on values in the primary key in the parent table. As such, any list created following the steps outlined in this section will be overridden.

Linked Fields

The Properties of linked fields can be modified through an interface provided in the Template Manager. Clicking any of the fields in the Linked Fields set activates an interface similar to the one shown in the following figure.



As with other standard fields, there is a number of view settings that can be modified by all users. These settings include:

- The names of one or more fields involved in the linked fields set;
- The default unit
- A default value
- Data display format
- An option to link the first field in a three-field linked fields to a list.

5.4 Managing Templates

5.4.1 Creating a new template

A new database template may be created during the project creation phase, using the Project Wizard. The new template will contain only the Stations table. The template can be further enhanced using the procedures listed above. It is not possible to create a new, blank template using the Template Manager.

5.4.2 Creating a copy of the current template

Once a project is created based on a selected database template, a copy of the database template will be added to the database for use as a user template. As such, the first time the Template Manager is opened it will only display this one user template.

As discussed earlier in this chapter, multiple user templates can be created from this copy. All users have the ability to make a copy of this template, modify, and save view settings in this newly created user template.

To create a copy of the current template, select the (Copy Template As) button at the top of the window. A dialog will appear prompting for a template name and description. Once a name is provided for the new template, all changes will be saved to this template.

5.4.3 Saving a template as default template

Saving a template as the default template makes that user template the default for all users. When HydroGeo Analyst opens your project, it will utilize this default template for view settings.

To set the template as default, select the "**Use as Project Default**" option at the top of the window.

5.4.4 Exporting the current template as a Database template

Any user template can also be exported to a database template. This feature allows you to modify the database schema and save it for future use.

To export the selected user template to a database template, click on the (Save as a database template) button. A dialog will appear prompting for a template name and description. Once a name is provided for the new template, all changes will be saved to this template. The template will be saved with the extension .XML, and the corresponding lists and templates will be saved in an .MDB file. The Templates are saved in the folder: ..\Program Files\HGAnalyst\Templates\.

In addition to the current database schema, the following entities are saved to the database template, upon exporting:

- Report templates
- BHLP templates
- Plot templates
- User-defined Soil Classification Systems (SCS)
- Lists (defined in the List Editor)
- Project Level Security Document (PLSD): defined with the User Access Management)

6

The Data Transfer System

The Data Transfer System (DTS) is a flexible tool used for importing and exporting data into and out of a HydroGeo Analyst project. When starting a new project, it may be necessary to import data from other sources into the HG Analyst database. Data may exist in such sources as Text Files, MS Excel or other spreadsheets, MS Access, SQL servers, or Oracle databases. The DTS is designed to import data from such sources into the HGA database.

In addition, data may be exchanged (import and/or export) between the HG Analyst database and various other data sources during the lifetime of a project. Such imports/ exports in most cases will involve the HG Analyst database and other sources such as spreadsheets, delimited text files, and other database formats such as MS Access.

The DTS is designed to:

1) Import data into the HG Analyst database from such sources as:

- Spreadsheets (e.g. Excel, Quattro Pro, Lotus 123)
- Delimited Text files (e.g. Comma separated text files)
- Other databases (e.g. from one or more tables in a MS Access database)

2) Export selected data to destinations such as:

- Spreadsheets (e.g. Excel, Quattro Pro., Lotus 123)
- Text files
- Other databases (e.g. to a table in an MS Access database)

3) Export one or more HG Analyst tables to an external database (MS Access, SQL Server)

This chapter describes in detail the Data Transfer System (DTS) provided with HydroGeo Analyst.

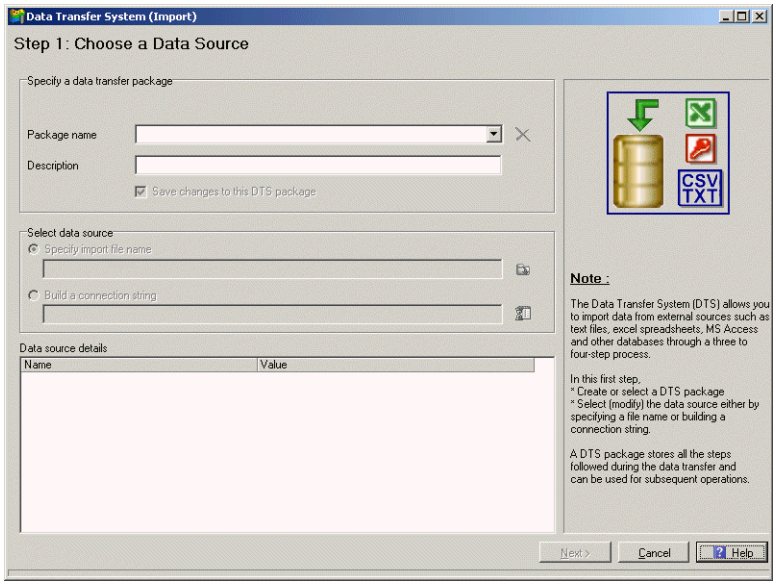
Starting the DTS

The DTS can be used for both importing and exporting data. In HG Analyst, the DTS may be launched as follows:

- ☞ **Project / Import / Data** from the main menu, or click on the Data Import button on the main toolbar
- ☞ **Project / Export / Data** from the main menu or click on the Data Export button on the main toolbar

The DTS Export Process is explained in “Exporting Data using the DTS” on page 215.

The first window in the DTS Import Process is shown in the figure below:


Data Transfer System (Import)
Step 1: Choose a Data Source
Specify a data transfer package
Package name
Description
Save changes to this DTS package
Select data source
Specify import file name
Build a connection string
Data source details
Name
Value
CSV
TXT
Note :
The Data Transfer System (DTS) allows you to import data from external sources such as text files, excel spreadsheets, MS Access and other databases through a three to four-step process.
In this first step,
* Create or select a DTS package
* Select (modify) the data source either by specifying a file name or building a connection string.
A DTS package stores all the steps followed during the data transfer and can be used for subsequent operations.
Next >
Cancel
Help

In most cases, the DTS Import procedure will include four steps:

- **Data Source**: Specify the source file and package options
- **Data Mapping**: Map source fields to destination fields
- **Station Related Settings**: Specify projection system and units for the new stations being imported
- **Data Validation:** Validate the source data, and provides an error analysis report

Each step will appear in a new window. After specifying the required settings in each step, click the **[Next>]** button in the bottom corner to proceed. The **[Next>]** button is activated only after the required information has been defined in the current window.

The following few sections present a detailed description of each window of the DTS.

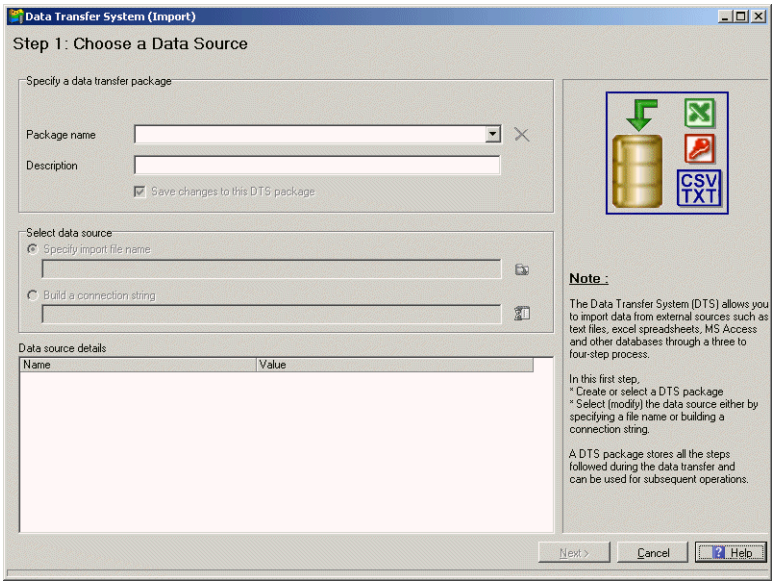
6.1 Importing Data using the DTS

The DTS allows importing data from various sources into any HG Analyst database table. The DTS allows importing data only for selected fields in the selected destination table; however some tables have required fields (such as ID, from, to, etc.) which must be mapped in order for each record to be imported.

To load the DTS for importing data,

☞ **Project / Import / Data** from the main menu

The first window of the DTS will be displayed as shown below.


Data Transfer System (Import)
Step 1: Choose a Data Source
Specify a data transfer package
Package name
Description
Save changes to this DTS package
Select data source
Specify import file name
Build a connection string
Data source details
Name
Value
CSV
TXT
Note :
The Data Transfer System (DTS) allows you to import data from external sources such as text files, excel spreadsheets, MS Access and other databases through a three to four-step process.
In this first step,
* Create or select a DTS package
* Select (modify) the data source either by specifying a file name or building a connection string.
A DTS package stores all the steps followed during the data transfer and can be used for subsequent operations.
Next >
Cancel
Help

The figure shown above depicts the interface that is provided to specify the data source for importing.

6.1.1 Choose a Data Source

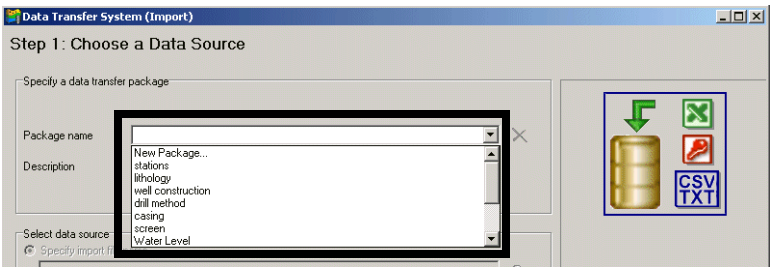
The first step in the DTS Import process is to select a data package and the data source file.

Data Transfer Package (DTP)

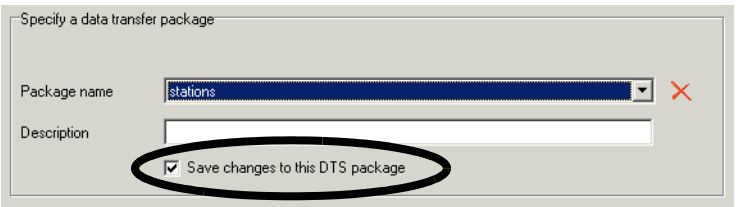
A Data Transfer Package (DTP) is designed to store all settings of desired import/ export operations that may be repeated from time to time. For example, importing lab analysis results to the database, which follow a consistent format. The DTP contains

information about the data source, the selected destination table, matching between source and destination tables and fields and a number of other settings.

All Data Transfer Packages (if any) are listed for selection at the beginning of all data transfer operations. If an existing package is selected, the DTS loads all information stored in the package. The information can then be reviewed and updated as desired before as you move through the data transfer operation.



At the beginning of the import/export operation you can select the option which saves the changes you made to the package in each step of the procedure.



A new data transfer package can also be created in which case all information provided to the DTS during a specific data transfer operation will be saved to the package once the transfer operation is completed successfully.

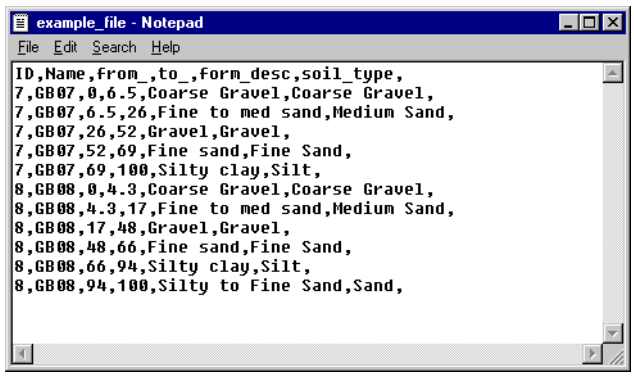
Select the Data Source

Once a data package is selected or created, the data source can be defined. The format of the source file must be “Records as Rows”, which means each new record must be in a new row; in addition, if the file contains Header information, the Header must be in the first row. If the source format is a database, then in most cases these requirements will be satisfied. However, if Excel or Text formats are used, ensure that the necessary formatting is completed before using the DTS. A few examples are shown below.

The following example demonstrates an Excel file containing station location data; note the format (records as rows), and the header information in the first row:

	A	B	C	D	E	F
1	ID	Name	X	Y	Elevation	TOC
2	1	GB01	536012.7	4813630	333.5	334.5
3	2	GB02	535956.7	4813650	336	337
4	3	GB03	535879.7	4813670	336	337
5	4	GB04	535753.7	4813620	332	333
6	5	GB05	535648.7	4813660	334	335
7	6	GB06	535543.7	4813670	340.5	341.5
8	7	GB07	535452.7	4813630	343	344
9	8	GB08	535298.7	4813640	339.5	340.5
10	9	GB09	535186.7	4813660	339.5	340.5
11	10	GB10	535095.7	4813630	348	349

The following example demonstrates a .CSV file, containing lithology information for a few stations; note the format, and the header information in the first row:



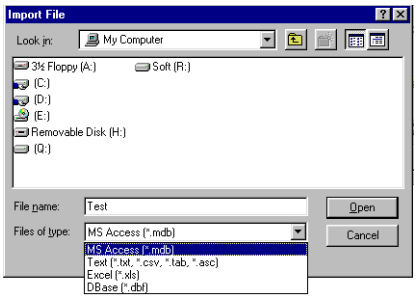
NOTE: It is recommended that you have a header in the first row of your source file, to simplify data mapping in Step 2.

The method of selecting a data source mainly depends on the type of the data source. There are two options:

- **Specify Import File Name** (quick and easy for text files, spreadsheet, and MS Access Database data sources on a local or network machine); OR
- **Build a Connection String** to a file using the standard Universal Data Link (UDL) properties dialog. (More appropriate for data sources on a server or network computer).

Specify Import File Name

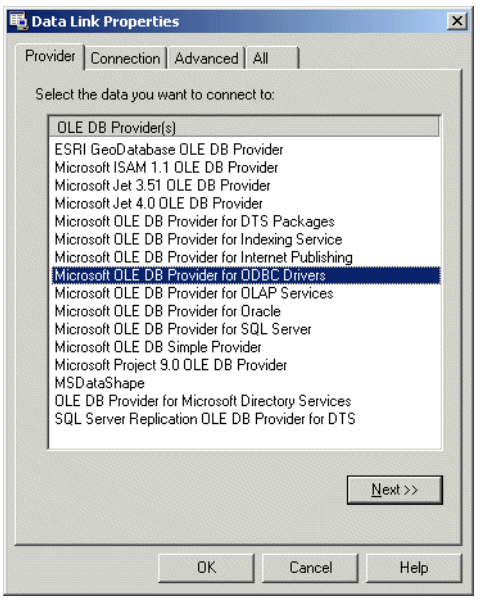
To specify a file directly, select the radio button beside the "**Specify Import File Name**" option, then click on the (Open file) button to load the following dialog:



- Select the appropriate file type
- Browse to the folder containing the file
- Highlight the desired file
- Click **[Open]**
- Click the **[Next>]** button in the lower right corner to proceed to the next step

Build a Connection String

To build a connection string, select the radio button beside the **"Build Connection String"** option, then click on the (Build Connection String) button to load the following dialog:


Data Link Properties
Provider
Connection
Advanced
All
Select the data you want to connect to:
OLE DB Provider(s)
ESRI GeoDatabase OLE DB Provider
Microsoft ISAM 1.1 OLE DB Provider
Microsoft Jet 3.51 OLE DB Provider
Microsoft Jet 4.0 OLE DB Provider
Microsoft OLE DB Provider for DTS Packages
Microsoft OLE DB Provider for Indexing Service
Microsoft OLE DB Provider for Internet Publishing
Microsoft OLE DB Provider for ODBC Drivers
Microsoft OLE DB Provider for OLAP Services
Microsoft OLE DB Provider for Oracle
Microsoft OLE DB Provider for SQL Server
Microsoft OLE DB Simple Provider
Microsoft Project 9.0 OLE DB Provider
MSDataShape
OLE DB Provider for Microsoft Directory Services
SQL Server Replication OLE DB Provider for DTS
Next >>
OK
Cancel
Help

The **Data Link Properties** dialog box is the standard Windows system interface for configuring connection strings to data sources. This dialog box exposes all of the properties that the selected OLE DB provider supports.

The Data Link Properties dialog box contains four tabs: **Provider, Connection, Advanced,** and **All**. The settings available on the latter three tabs depend upon the Provider selected.

The **Provider** tab of the Data Link Properties dialog box is used to select the appropriate OLE DB provider for the type of data you want to access.

Use the **Connection** tab of the Data Link Properties dialog box to specify where your data is located, and how to connect to it using an OLE DB provider. The connection information can be represented using a common string format. This tab opens by default when you double-click a data connection in Server Explorer.

Note that the fields displayed on this tab depend upon the OLE DB Provider selected. For example, if you select the OLE DB Provider for Oracle, the **Connection** tab displays fields for the server name and login. If you select the OLE DB Provider for SQL Server, then the server name, type of authentication, and database must be furnished.

For more information about the Data Link API, visit msdn.microsoft.com (open the MSDN Library Online and then the Platform SDK to find the MDAC SDK, which contains the Data Link API Reference) or see “Appendix C: Using the Data Link Properties for Importing” on page 521.

Once the connection string has been defined, click **[OK]** to accept it

- Click the **[Next>]** button in the lower right corner to proceed to the next step.

The next step is Data Mapping.

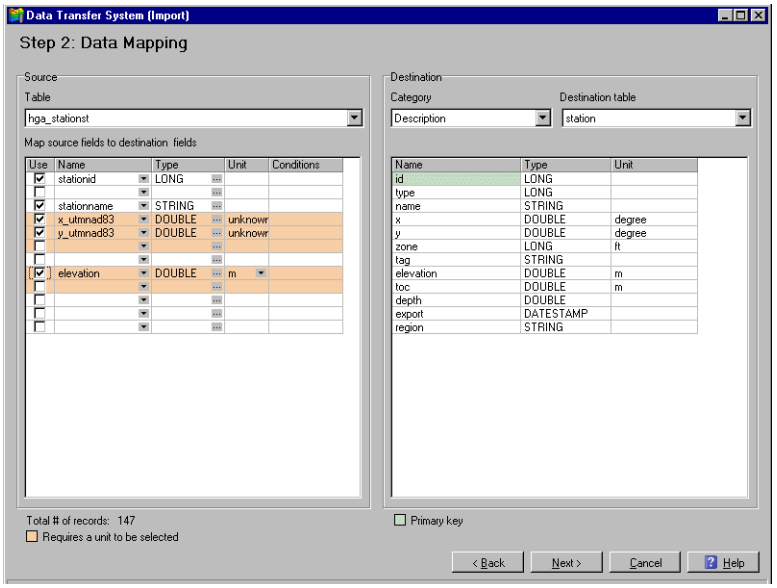
6.1.2 Data Mapping

The next step in the data transfer operation is to match a source table with a destination table.

The Data Mapping window is divided into two frames:

- The **Source** table and fields, found on left side of the window; and
- The **Destination** tables and fields, on the right side of the window

The Data Mapping window is displayed below.



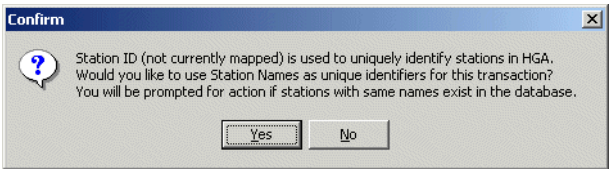
The **Source** database table (which contains the data to be imported) can be selected from the list of tables, available on the left side of the window. Note that if the data source is a text file or a spreadsheet, only one table will be available for importing. The DTS makes an effort to automatically map fields from this table with those in the selected destination table. If the field names are identical, then the fields will be matched automatically. Unmapped fields will appear blank; this indicates that the DTS was unable to match the source field to a field in the HydroGeo Analyst database template. Therefore, a field must be manually selected from the available list, and mapped to the appropriate source field.

The **Destination** frame contains the data categories and tables in the current database structure. From this frame, select a **Category**, then a **Table** from this category, and a list of fields will be displayed in the grid on the right side of the window.

Data Requirements

In the previous version of HGA, the DTS required all source tables to contain a numeric Station ID, in order to map data to the correct stations in the stations table. The benefit of this design is that the database could support duplicate station names; the disadvantage was that in many situations, numeric station ID was not available, and had to be manually added to the source tables, either by-hand or through the use of queries.

Although numeric Station IDs are still the ideal unique identifiers for stations, this is no longer a requirement. You may now use Station names as a unique identifier in source tables, in order to map data to the correct stations. When you import stations, and only the Station Name is mapped, the following confirmation message will appear before Step 3 in the DTS:


Confirm
Station ID (not currently mapped) is used to uniquely identify stations in HGA.
Would you like to use Station Names as unique identifiers for this transaction?
You will be prompted for action if stations with same names exist in the database.
Yes
No

When importing additional data from child tables, and the source files contain only the station names, the DTS will search for the appropriate Station IDs in the station table (based on station names) and map the data to appropriate stations.

In the case where there are duplicate station names, please see the explanation listed in “Duplicate Stations” on page 211.

Import Order

NOTE: When importing, be sure to import data for the parent tables before the child ones. For example, Stations must be present in the database, before you can import chemistry or lithology data for these stations. Likewise, for soil or groundwater chemistry data, you must first define or import the Sys_Sample_codes, in the parent table, then run through the DTS again to import the sample results into the correct fields.

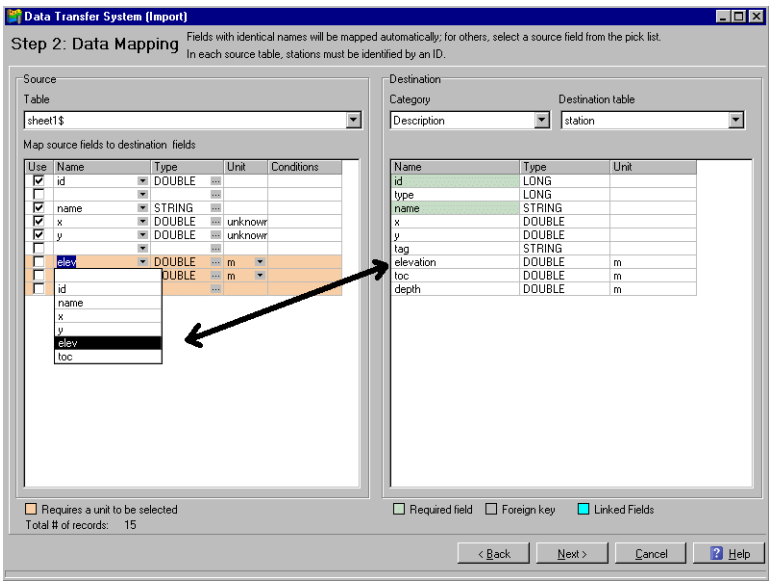
How to Map Fields

Follow the directions below to map fields in the source table to a destination table:

- ☞ Select the Destination **Category** from the list on the right side of the window
- ☞ Select a Destination **Table** from the list on the right side of the window
- ☞ Select the Source Database **Table** from the list on the left side of the window

Under the **Source Table**,

- ☞ Click once in the **Name** column of a blank field across from the destination field where you wish to import the data. A list of available fields will appear, as seen in the example below:



- ☞ Select the appropriate source field from the list. In the example shown above, the appropriate field is **Elev**, since it should be mapped to the field **Elevation** in the **Station** destination table.
- ☞ Select the appropriate **Unit** for the field, if applicable. Fields that are shaded orange require a unit selection.

NOTE: The units for station X,Y co-ordinates will be defined in Step 3 of the import routine.

- ☞ Check the **Use** box beside the appropriate field, to include this field for importing.

Repeat this for other fields, until all necessary fields have been mapped to fields in the Destination table.

NOTE: As a minimum, one field in the source table must be mapped to the primary key field in the destination table. The primary key field is shaded in green, and is typically the first field in the destination table. The primary key is the Station ID (ID)

- ☞ **[Next]** to proceed to the next step in the DTS.

Some of the additional features and options available in the Data Mapping window are explained below.

Unit Conversion

The DTS allows conversion of data from source units to the unit specified for each corresponding destination field. If a destination field with a matching source field has a unit, the DTS requires that a unit be selected for the source field before proceeding with the data import operation. A unit can be selected from the list of units available for the specific unit category.

Importing Criteria

The DTS allows specifying a simple criteria (condition) for each field that is selected to be imported. The criteria will be used to filter the source data. For example, you can import data only for a specified station (i.e. Elevation > 300 or Name == OW-1 and so forth). If a criterion is specified based on a field with numeric data types, it should be compared against values that have been converted to the destination field's unit.

This version of the DTS supports only one condition per field. The condition should be provided through an operator (==, <, >, != or <>) followed by the value for the condition. For instance in the above example, if importing data only for the station 'OW-1' is desired, the condition should simply be stated as '== OW-1'. Similarly, if data for all stations except 'OW-1' are to be imported, the criteria should be provided as '<>OW-1' or '!=OW-1'.

NOTE: For the "equals" operator, you must enter a double equal sign, with no spaces (i.e. ==).

The DTS understands the syntax described in the following table:

Operation	Operator	Comments
Equal to	==	
Not equal	!=	
Greater than	>	For numeric fields only
Less than	<	For numeric fields only
Greater than or Equal to	>=	For numeric fields only
Less than or equal to	<=	For numeric fields only

Rules

Spaces are allowed before and after the operators. For example:

<= 10

>= 10

== 10 (note that the equal sign is two equal signs together with no spaces in between)

However, spaces between operators is not allowed. For example:

<= 10 is correct

== 40

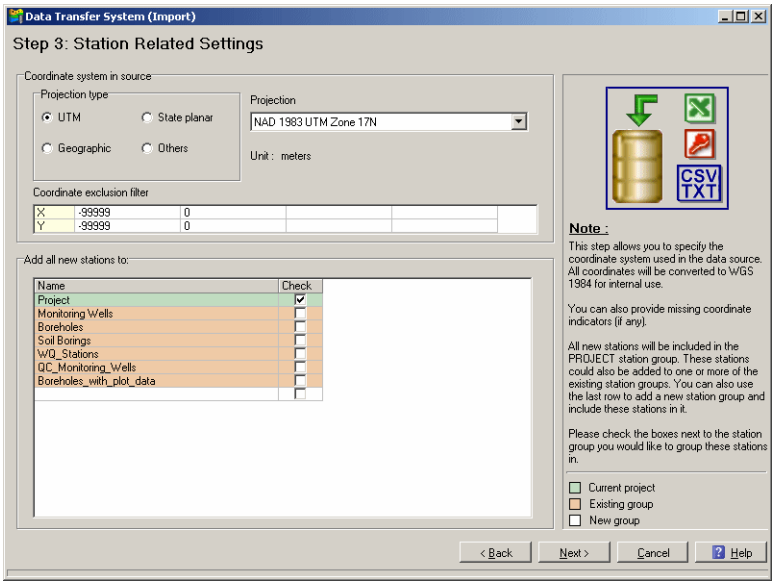
< = 10 is not correct

= = 40 is not correct (there is a space between the two = signs.

Those records not satisfying the import criterion will be highlighted in yellow under the preview window and a warning message will be shown at the top. In order to filter these records, select the corresponding warning and click on the “Reject” button just below the control that lists warnings and errors. See section 6.1.4 on page 213 for details.

6.1.3 Station Related Settings

If the data to be imported contains information for new stations, some additional information may be required in order to allow proper data transfer. The **Station Related Settings** window (as shown below) will only be displayed if data is imported to the **Stations** table.


Data Transfer System (Import)
Step 3: Station Related Settings
Coordinate system in source
Projection type
UTM
State planar
Geographic
Others
Projection
NAD 1983 UTM Zone 17N
Unit : meters
Coordinate exclusion filter
X -99999 0
Y -99999 0
Add all new stations to:
Name
Check
Project
Monitoring Wells
Boreholes
Soil Borings
WQ_Stations
QC_Monitoring_Wells
Boreholes_with_plot_data
CSV TXT
Note :
This step allows you to specify the coordinate system used in the data source. All coordinates will be converted to WGS 1984 for internal use.
You can also provide missing coordinate indicators (if any).
All new stations will be included in the PROJECT station group. These stations could also be added to one or more of the existing station groups. You can also use the last row to add a new station group and include these stations in it.
Please check the boxes next to the station group you would like to group these stations in.
Current project
Existing group
New group
< Back
Next >
Cancel
Help

Projection Settings

The DTS requires you to define the coordinate system, the projection system, and the units for the stations in the source file. Following successful import, the new stations will be converted to the projection system and units defined in the HydroGeo Analyst project. A detailed description of the coordinate and projection systems available in HydroGeo Analyst is provided in Chapter 4. See “Step 3: Set Project Properties and Location” on page 175.

NOTE: It is important to know and select the correct project system during the import, to prevent erroneous station co-ordinates.

Coordinate Exclusion Filter

The DTS also provides the option to indicate excluded coordinates. Excluded coordinates could be coordinates used as place holders in the source file, in cases where coordinates are unknown. For example, the value -9999 may be entered if the X or Y coordinate does not exist or is unknown. If this is the case, these coordinate values should be entered in the appropriate field. In the screen shot shown above, the value -9999 is entered for both X and Y coordinates. In this case, stations with these values will be excluded from the import. These coordinates could also represent erroneous coordinates.

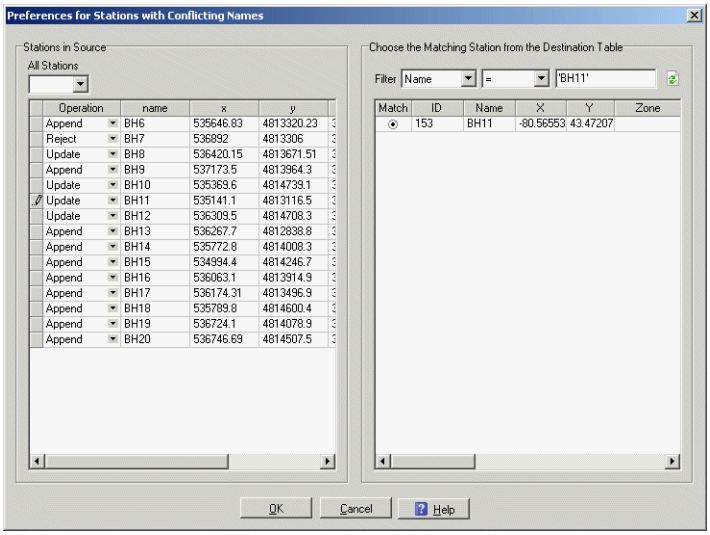
Add Stations to Group

Another feature provided in the “Settings” tab of the DTS is that of grouping new stations as desired. The DTS lists all station groups available for the project. All newly imported stations will be added to the “Project” station group by default. If selected these stations will also be inserted in one or more of the station groups listed in this tab. You can also enter a name of a new station group in the last row, and the stations will be inserted to this new group, if desired.

Duplicate Stations

Since Stations can use an ID as the unique identifier, the DTS allows you to store stations with duplicate names in your database. Duplicate Station names are common in larger projects, that may involve stations from various sites.

If you attempt to import duplicate station names, or import a station name which duplicates one already existing in the database, the DTS will present the following interface:



If the DTS finds one or more stations in destination with same name as in source, they will be displayed and managed in this table.

All **Stations in the Source** table with conflicting names in destination will be listed in the left grid, sorted alphabetically by station names. The right grid displays all stations in the **Destination** (in your project database) whose names are the same as the station selected on the left; Stations will be sorted by ID in ascending order. In the right side of the table, you can select only one station to match to the station selected on the left side.

The left grid will contains the column **Operations** that will display combo boxes for each row. The combo boxes contain three options:

- **Append**: Import the station as a new station in the destination table
- **Update**: Map the correct station ID in the destination table to a Station name in the source table
- **Reject**: Reject the station. The DTS will not import rejected stations

By default, the operation will be set to **Append** (i.e. duplicate stations will be imported as new stations).

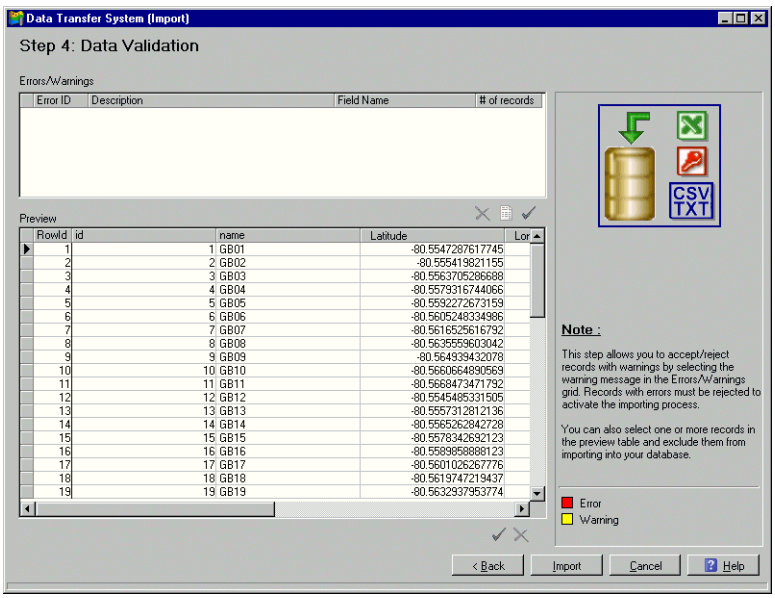
If **Update** is selected for a station on the left grid, the right grid will display the first potentially duplicate station. Using the right grid, you may select the appropriate destination station to be updated. If the destination contains more than 1 station with the same name, you must choose the appropriate one, by selecting the appropriate radio button.

Above the left grid, you will see the **All Stations** combo box with four items (Append, Update, Reject and blank). This combo box will control the group operations, and allow you to apply the same operation to all stations listed on the left grid. The default selection in this combo box will be the **Append** option.

Above the right grid, the **Filter** controls can manipulate what stations will be displayed in the destination (right grid). By default, all stations with the same name will be displayed. However, you may select any field, an operation (e.g. =, >, Like, Is Not,…) and a criteria that will be used to retrieve stations from the destination. This feature allows you to locate Stations that may be already in the database, but with names that were misspelled or entered incorrectly (e.g. MW-1, MW_1, MW1, etc.).

6.1.4 Data Validation Report and Finalizing the Import

The last step in the DTS involves previewing the data to be imported, and taking appropriate actions with regards to erroneous data. The **Data Validation** window (as shown below) displays all data ready to be imported. Errors or warnings, if any, will be listed along with the data.



The data is checked against three conditions, namely:

- Proper Station Locations
- Specified conditions for each field (if any)
- Data type compatibility

NOTE: All coordinates in the database are **stored** in latitude-longitude format, regardless of the projection system in the source file and project. The **Preview** in this window displays the converted station co-ordinates. However the station co-ordinates may be **displayed** in HydroGeo Analyst in any projection system desired.

Accepting or Rejecting Errors/Warnings

The records that fail to satisfy each of the above conditions will be indicated in the "Errors and Warnings" table. By default all data marked as erroneous will not be imported. However, all warnings are ignored by default. One or more of these error messages can be selected, and the data affected by those errors can either be rejected or accepted. Note that only data with a warning message may be accepted. Erroneous records will not be accepted for importing unless the errors are fixed. The values that cause the errors are highlighted in different colors.

Records shaded red indicate Errors that must be addressed before the Import can continue.

Records shaded yellow indicate a Warning or Caution, with a corresponding message.

To accept the posted warning messages, and import these records, select the items and click the (Accept) button.

To reject the posted warning messages, and ignore these records from the import, select these items and click on the (Reject) button.

To view the error report, click on the (Display log file) button.

Accepting or Rejecting Records

Any of the records in the preview window may be accepted or rejected.

To accept the selected records, click on the (Accept) button.

To reject the selected records, click on the (Reject) button.

Finalizing the Import

Once you have removed or verified the errors,

☞ **[Import]** button to import the data to the project.

After successfully importing the data, a confirmation window will appear, similar to the one shown below.

If all desired data transfer operations are done, the DTS can be closed by clicking on the **[Close]** button. If, however, that is not the case the **[Back]** button can be selected to go back to previous tabs and specify a new data source and/or table for importing.

To close the DTS, and return to HG Analyst,

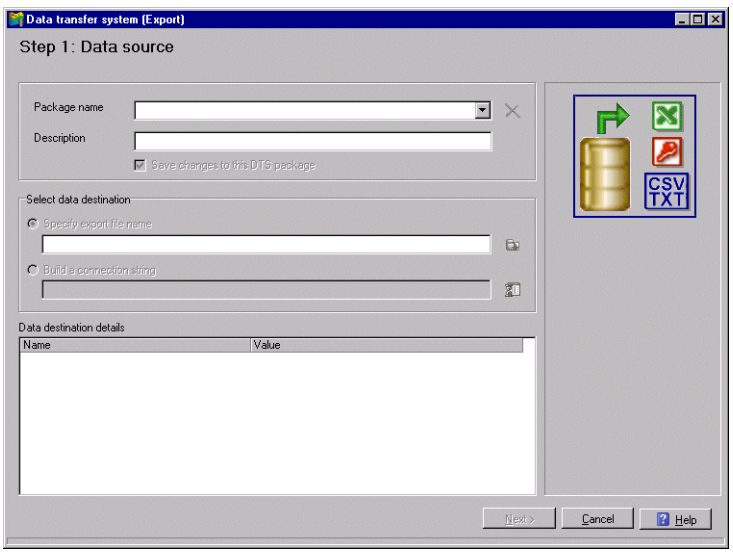
☞ **[Close]** button at the bottom of the DTS window.

6.2 Exporting Data using the DTS

HydroGeo Analyst supports exporting data to other destinations in two ways:

- The first and more direct way of exporting data uses a gridded data format. This option is available under the **Project** menu**, Export / Grid**. The current active grid can be saved in .CSV, .XML, .MDB, .SHP, or .HTM formats.
- The second method of exporting data allows data transfer from one or more selected tables to practically any OLE DB supported destination. These destinations may include MS Access database, SQL Server database, Oracle databases and many others. A dialog similar to that used for importing data into HG Analyst database is launched whenever this feature is requested.

To export data using the DTS, select the menu option **Project / Export / Data**, and the following window will appear:



6.2.1 Specify Data Source and Package

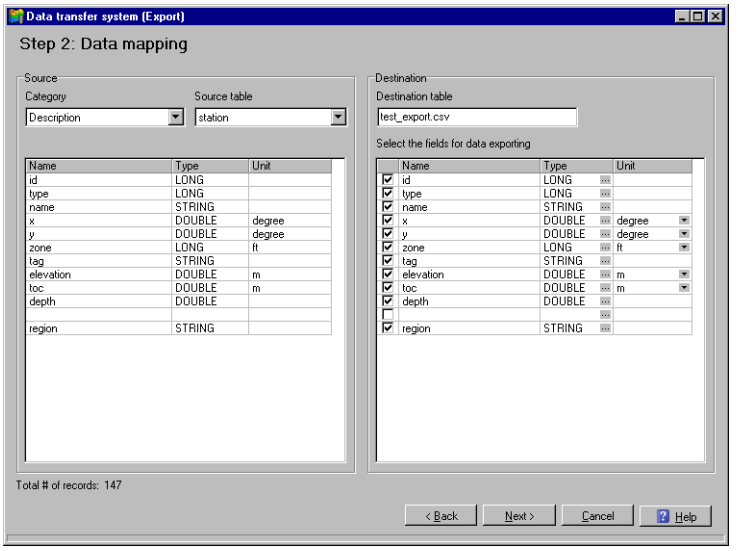
Similar to data importing, the first step in the data transfer operation is to provide the desired destination. The Destination can be provided either as a file name (wherever applicable) or as a connection string. First a data package must be selected, or a new one created, from the **Package Name** field in the first line. Then, select a folder, a file format, and enter a filename. Once this has been defined,

☞ **[Next]** to proceed to the next step in the DTS.

6.2.2 Select Tables to Export

The second window (as shown below) requires you to select the tables to export.

In addition to selecting the source and destination tables, this interface also allows selecting the desired destination fields to which data from the selected table will be exported.



Unit Conversion

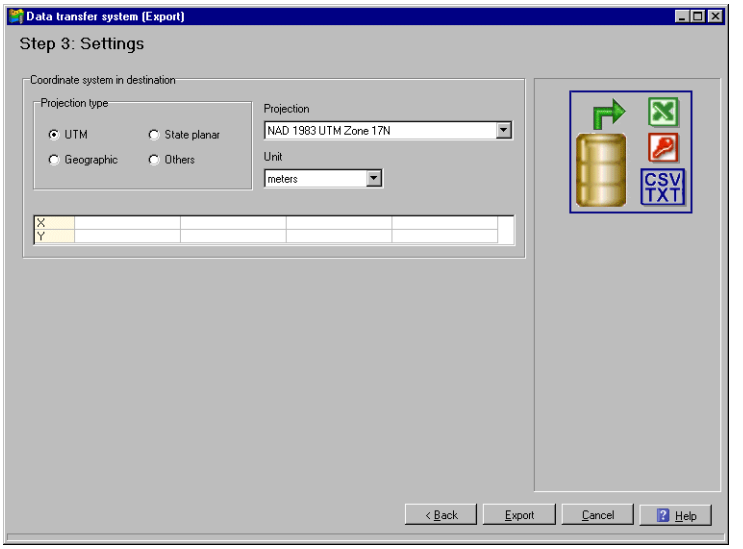
By default, the data from those fields with units will be exported in the same units as the source. However, any unit from the same unit category can be selected, and the appropriate conversions will be made by the DTS. For instance a ground surface elevation that is stored in metres in the database can be exported in feet in the destination table.

Once the mapping is complete,

☞ **[Next]** to proceed to the next step in the DTS.

6.2.3 Station Related Settings

Similar to the import procedure, if you export station data, you must specify the projection type and projection for the stations in the exported file.



Once this is complete,

☞ **[Export]** button, and

☞ **[Close]** button to complete the process.

7

Queries

This chapter provides a detailed description of the Query Builder and Crosstab queries. Within a HydroGeo Analyst project, it may be necessary to perform different types of queries for data filtering, reporting, and management. A few examples of data queries are provided below:

- Select wells drilled later than 1995 and earlier than 2000
- Select wells with discharge over 500 gpm
- Select boreholes deeper than 150 feet
- Select boreholes where the overburden thickness exceeds 20 feet
- Locate groundwater concentration exceedances for BTEX

In the Query Builder window, the query fields and conditions can be quickly defined. Once the queries have been created, they may be easily accessed from the Project Browser, where each new query will appear as a new node. Using the Query Builder, it is possible to create two types of queries:

- Station Group Queries, and
- Data Queries

Each query type is discussed later in this chapter.

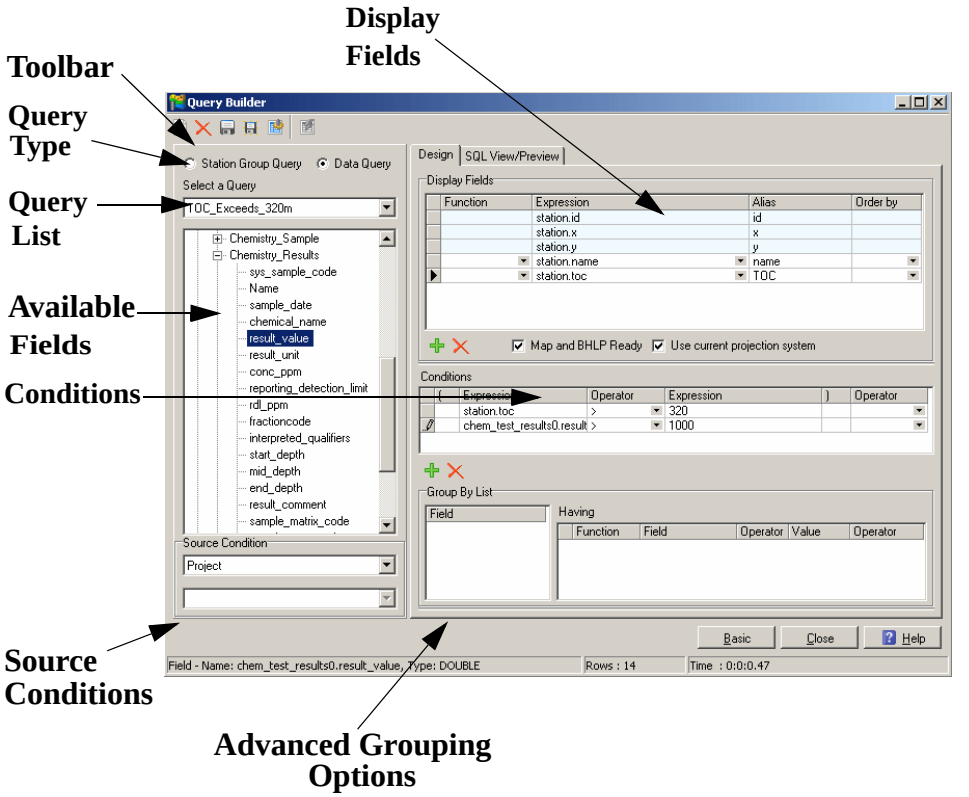
Additionally, once a query is created, it is possible to generate a CrossTab Query using the query data. Crosstab Queries are discussed in section 7.8 on page 241.

7.1 About the Interface

The Query Builder may be loaded from HydroGeo Analyst in several ways:

- Select **Tools > Query Builder** from the main menu;
- In the toolbar, click on the (Query Builder); OR
- In the **Query** branch of the Project Browser, right-click on an existing query, and select **New** or **Edit**.

The Query Builder window is shown below. This display shows the options for a Data Query.



NOTE: The Query Builder window is context sensitive. The window will contain different settings depending on the selected Query type.

The Query Builder window contains the following items:

- **Display Fields***: Select the display fields for the query
- **Toolbar**: Contains short-cut buttons to most of the functions in the Query Builder
- **Query Type:** Choose from a Station Group Query or a Data Query
- **Query List**: Select an existing query from the list
- **Available Fields:** Select fields for the query from the tables in the database.
- **Conditions:** Displays the Query conditions
- **Source Conditions**: Select the source options for the query.
- **Advanced Grouping Options***: Specify grouping and sorting options.

NOTE: *These options are available for Data Queries only.

7.1.1 Description of Toolbar Items

The toolbar provides access to most functions of the Query Builder. Toolbar buttons are context sensitive; if there are no options available, the respective toolbar button(s) will become inactive, indicated by a “greyed-out” appearance.

New button creates a new query.

Delete button deletes the selected query.

Save Query button saves the query.

Save As button saves the query under a new name.

Generate SQL Statement button generates the SQL statement and tests the query.

Execute SQL Statement button executes the selected query string.

7.2 Query Types

7.2.1 Data Queries

Data Queries can provide a more detailed look at the data, and can be used for quantifying and qualifying any field in the HGA database.

In addition, many of the visualization and data analysis components require data sources as data inputs. Using the Query Builder, you can generate Data Queries that provide the data sources for:

- Map Layers (see Chapter 8: for more details)
- Cross section interpretation results (see Chapter 9: Querying Cross Section Interpretations for more details)
- Quality Control Analysis (see Chapter 13: Applying a Lab Quality Template for more details)
- BHLP columns (see Chapter 12: Specify Data Source for more details)
- Crosstab reports (see Chapter 7: Crosstab Queries for more details)

- 3D plume projects (see Chapter 3: 3D Interpolation for more details)
- Charts (see Chapter 14: Adding Plots for more details)
- Customized Reports (see Chapter 11: Creating Reports based on a Data Query for more details)

To create a Data Query, select the **Data Query** radio button from the upper-left section of the Query Builder window. Then, define the necessary conditions, generate the SQL statement, and execute the query. Once the query has been created and saved, the query will appear as a new node in the project browser, under the Queries node.

For more information on how to build a Data Query see “Data Query - Example” on page 222.

7.2.2 Station Group Queries

Station Group Queries provide the foundations for new Station Groups; these queries can be built and executed for the purpose of organizing the stations into specialized groups.

To create a Station Group Query, select this option from the upper-left section of the Query Builder window. Then, define the necessary conditions, generate the SQL statement, and execute the query. Once the query has been created and saved, the query will appear as a new node in the project browser, under the Station Groups node.

> **NOTE:** Station Group Queries do not have options for modifying the display fields, or advanced grouping options.

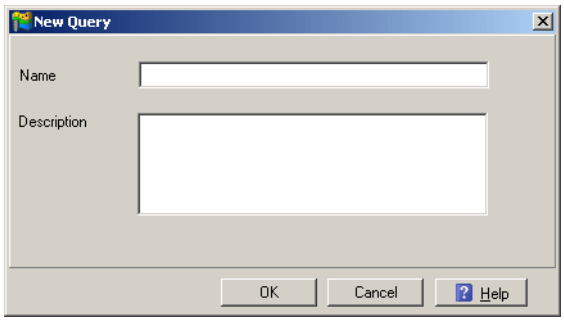
For more information on how to build a Station Group Query see “Station Group Query - Example” on page 232.

7.3 Creating Queries

7.3.1 Data Query - Example

Follow the steps below to create a data query.

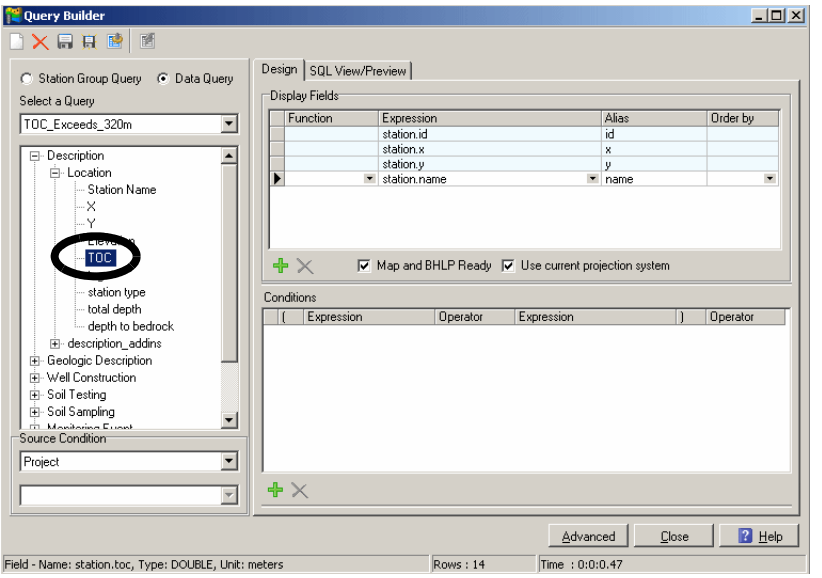
- If the Query Builder is not yet loaded, select the **Query Builder** option from the **Tools** menu.
- Select **Data Query** as the type, in the upper left corner of the window.
- In the toolbar, click on the (New) button, and the following window will appear:



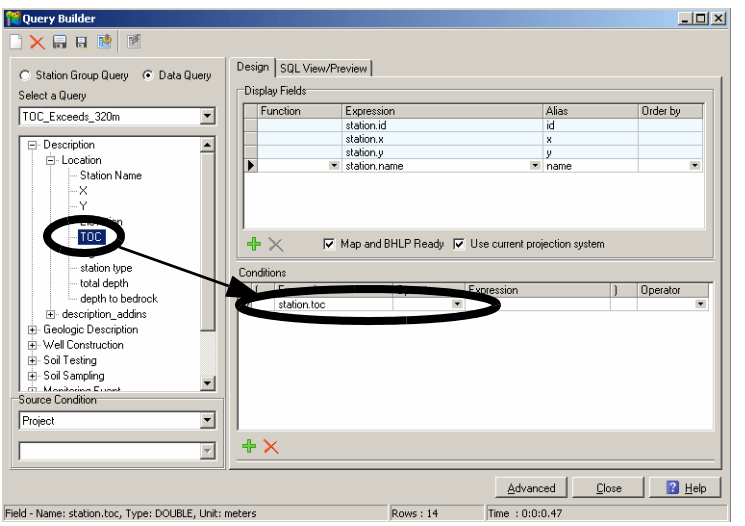
- Enter a **Name** for the new query (e.g. “TOC Exceeds 320m” for this example), and a **Description** (optional).
- Click **[OK]**

NOTE: Query names should contain alphanumeric characters only. Do not use characters such as <, >, \, (,), etc.

- In the lower-left corner of the Query Builder window, select the **Source Conditions**. The options are Station Group, Project, and Database. If **Station Group** is selected, then a second combo box will become active. From here, select the appropriate station group to query. If **Project** is selected, then all stations in the current project will be queried. If **Database** is selected, then the query will be applied to the entire database.
- Expand the tree on the left side of the window.
- Locate the desired data category, table, and field. For this example, select the **Description** category, then the **Location** table, and locate the **TOC** field. An example is shown below:

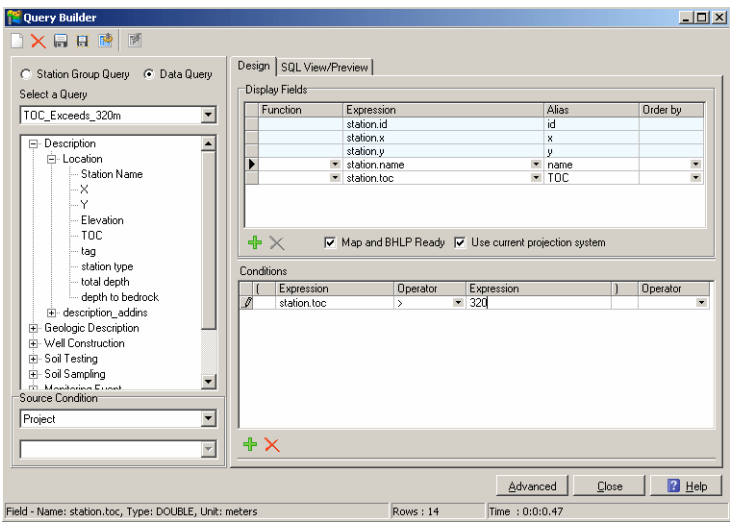


- Click once on the field, and drag this field into the blank **Conditions** field, under the **Expression** column. The selected field will be added automatically to the Query Conditions. (Alternately, you may use the (Add) button (on the bottom half of the window) to add conditions, then define them manually).



- Under the **Conditions**, select an **Operator** for the field. A combo-box with several options will appear: >, >=, <=, <, =, <>, !=, !<, !>, LIKE, IS, IS NOT, &, !. For this example, select "**>".**
- Enter a value in the second **Expression** field. For this example, type **320**.

- Next, add this field to the **Display Fields**. To do so, double-click on the **TOC** field in the Project Tree, and it will be added automatically as a new row in the **Display Fields**. Or, press the (Add) button (located below the **Display Fields**). Then, select the TOC field, and drag this field into the blank field.
- For each **Display Field**, there are Aggregate sorting **Functions**. Select from AVG, COUNT, MAX, MIN, STDEV, STDDEVP, SUM, VAR, VARP (These functions are explained on page 231). Otherwise, leave blank to apply no aggregate options.
- For each **Display Field**, **Order** options may be specified. Select from **ASC** (Ascending) or **DES** (Descending), or none.
- Once the fields have been added, the Query Builder display should be similar to the one shown in the figure below.



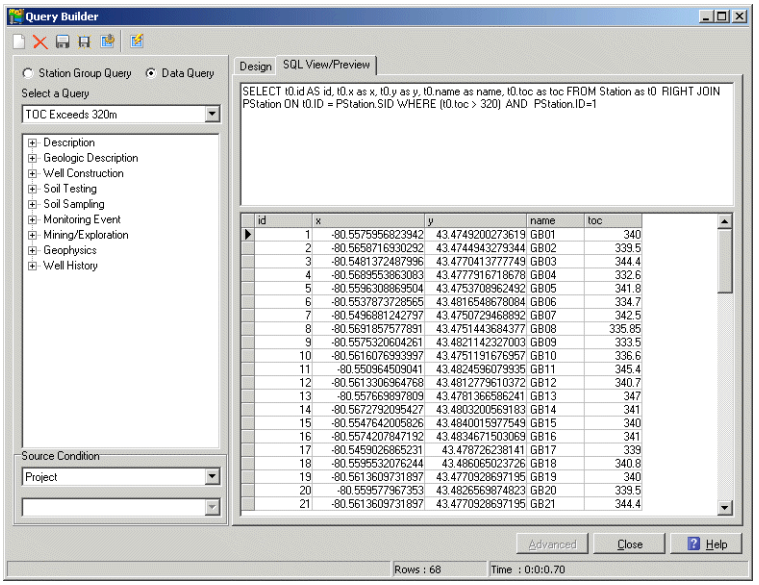
NOTE: The **Map and BHLP Ready** option ensures that the query will contain the required fields, enabling it to be plotted on a Map Manager/BHLP project. The required fields are Station ID, X and Y, and Station Name. If this option is checked, the required fields must be added, and cannot be modified.

NOTE: The Query Builder allows you to create map-ready queries in the project's projection system. When the queries are executed, X and Y coordinates are displayed in the lat-long format; however when the query is executed (through the main HGA window), or exported (to CSV, MS Access or .XML), the X and Y coordinates will be displayed in the current projection system.

- Press the (Generate SQL Statement) button at the top of the window to Generate the SQL string. If the query string is invalid, the violating rows will be highlighted red (indicating error) or yellow (indicating warning).
- Press the (Execute SQL Statement) button at the top of the window to

execute the query string.

- Select the **SQL View / Preview** tab to see the results of the query. The results of this query are shown in the window below:

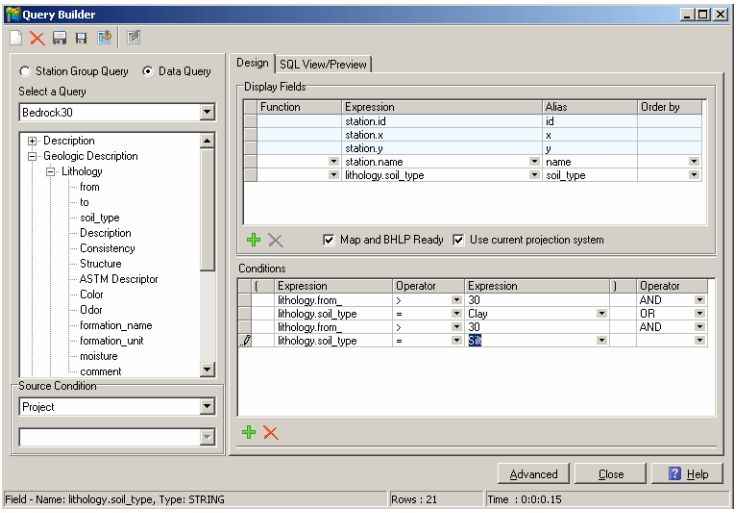


- Press **[Close]** to return to the main HydroGeo Analyst window.
- Click **[Yes]** when a prompt to save the query appears.

The new data query will now appear as a new node under the **Queries** node in the Project Browser.

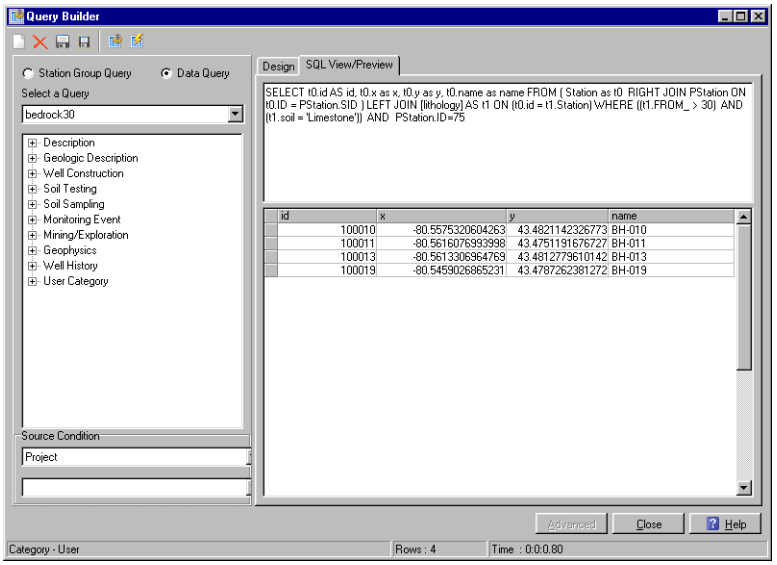
If additional **Conditions** are required for a more advanced query, follow the steps below:

- Create a new Query.
- Under **Conditions**, press the (Add) button. Using the same procedure described above, select a field from the tree, and drag and drop this into the new **Expression** field.
- Select an **Operator** and **Expression** value for the Condition.
- Repeat this step until all Conditions have been specified.
- The **Conditions** must now be linked with an additional operator. On the right side of the window, the **Operator** column can be expanded, and one of the following options may be selected: **AND, OR**.
- If it is necessary to enclose one or more conditions, double click in the outer fields surrounding the query condition, and parentheses ( ) will be added to the query condition. An example is shown below:



Enclosing the two or more conditions in parentheses allows you to further refine the query criteria. Use AND or OR operators inside and outside the groupings to combine the conditions so as to obtain the best results. For the example above, the query will return all stations in which at least one lithology interval begins below 30 meters AND contains clay, OR if the stations have at least one lithology interval that begins below 50 m AND contains Silt.

- Press the (Generate SQL Statement) button at the top of the window to Generate the SQL string. If the query string is invalid, the violating rows will be highlighted red (indicating error) or yellow (indicating warning).
- Press the (Execute SQL Statement) button at the top of the window to execute the query string.
- Press the (Save) button to save the query.
- Select the **SQL View / Preview** tab to see the results of the query. The results of this query are shown in the figure below:



You will see that the display fields show only the ID, Name, X, and Y. If desired, additional fields may be added to the display fields, using the steps listed above.

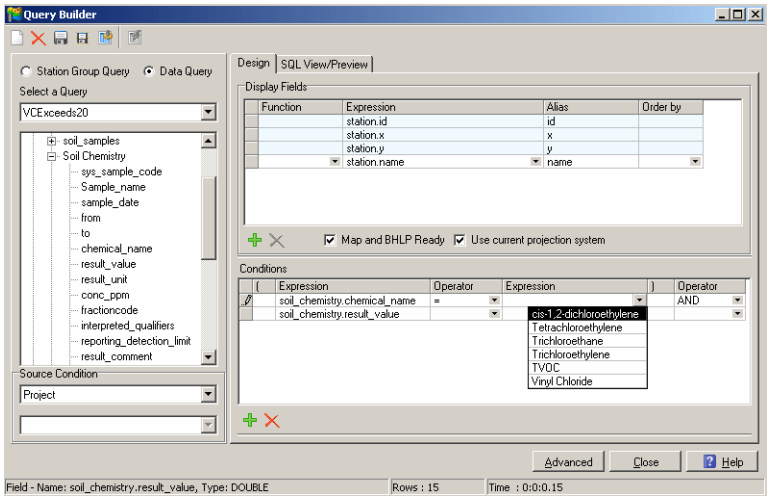
The query may now be accessed from the project tree, under the **Queries** node.

If the user is familiar with SQL string structure, the query string may be directly edited in the **SQL View / Preview** tab. Follow the steps listed above to execute the query.

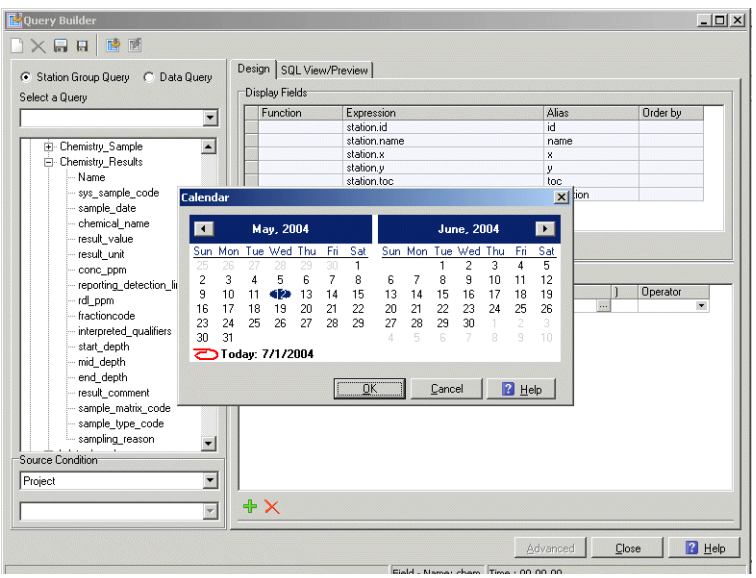
Adding a field which contains a Linked List

If a field is added to the Conditions which contains a Linked List, then the Expression field for the Condition may be chosen from a linked list. An example is illustrated below.

For example, it may be necessary to do a chemical exceedance query, such as Vinyl Chloride > 10 ug/l. The chemical name Vinyl Chloride may be selected from the combo box, since this chemical name is part of a linked list. See the example shown below.



Likewise, if a date is necessary for one of the Expression fields, simply double click on the date field, or press the [...] button, and a mini calendar will appear as shown below:

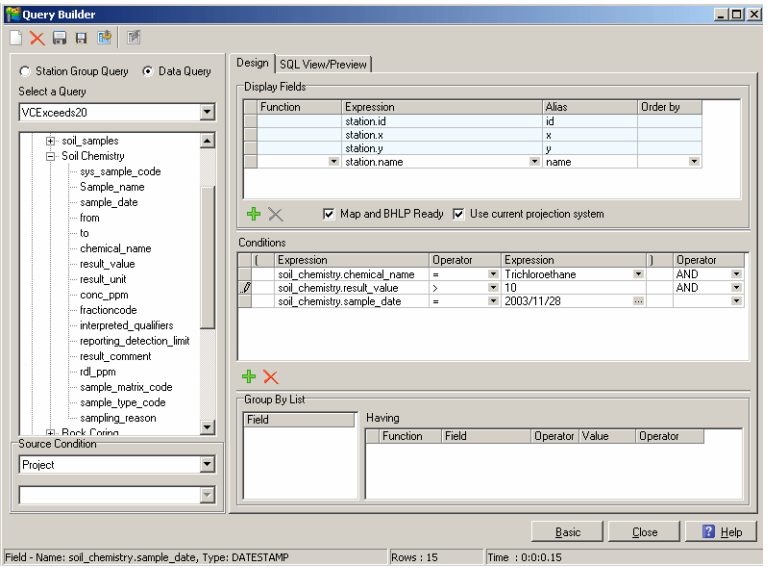


Select the appropriate date, then click **[OK]** and the date will be added to the conditions.

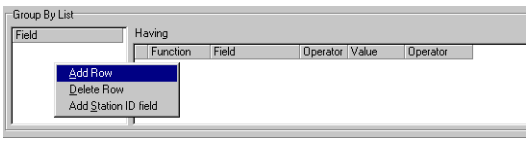
NOTE: To add the date to your query you can scroll through the calendar in increments of months. If the date you desire is too far in the past, it may be easier to type in the date manually, in the format compliant with your regional settings.

Advanced Data Query Options

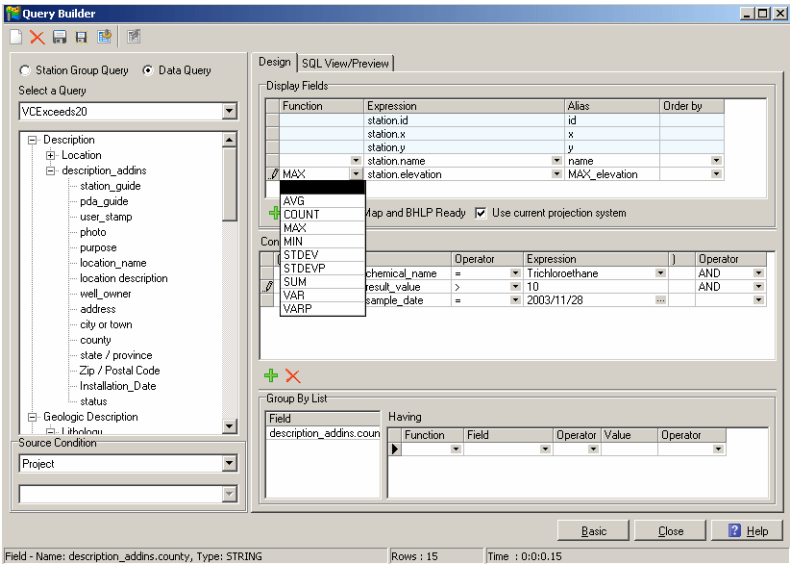
Data Queries may contain Advanced Grouping and Sorting options, providing a more detailed search of the database. To add grouping options, press the **[Advanced]** button at the bottom of the **Query Builder** window, and options will appear as shown below:



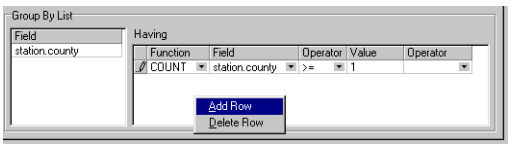
Under **Group by List**, any field may be added for additional grouping options. For example, if the Query Results are to be grouped by County or City, simply select this field, and drag and drop the field into the **Group By List**. Additional rows may be added to the Group options, by right-clicking and selecting **Add Row.**



Once the **Group By** conditional options have been specified, an aggregate function must be defined for the Display Fields; a common aggregate option must be selected for each **Display Field**, as shown below:



Under the **Having** frame, a condition may be applied to the **Group By** field. For example, if the query results are grouped by the field County, it may be necessary to locate the MAX result in each county, or the total COUNT in each County. To do so, right-click in the **Having** frame, and select **Add Row**



- Specify a **Function** (select from Aggregate options listed below):
  - AVG: Returns the average value of a numeric expression evaluated over a set.
  - COUNT: Returns the number of items in a collection.
  - MAX: Returns the maximum value of a numeric expression evaluated over a set.
  - MIN: Returns the minimum value of a numeric expression evaluated over a set.
  - STDEV: Returns the sample standard deviation of a numeric expression evaluated over a set.
  - STDDEVP: Returns the population standard deviation of a numeric expression evaluated over a set.
  - SUM: Returns the sum of a numeric expression evaluated over a set.
  - VAR: Returns the sample variance of a numeric expression evaluated

over a set, using the unbiased population formula.
    - VARP: Returns the population variance of a numeric expression evaluated over a set, using the biased population formula. (Reference: http://msdn.microsoft.com/library/)
- Specify a Group **Field**; the group field must be selected from one of the fields specified in the **Group By List**.
- Select an **Operator** and a corresponding **Value**.
- Repeat for additional conditions.
- Multiple conditions must be linked by selecting an appropriate **Operator**: AND, OR.
- Press the (Generate SQL Statement) button at the top of the window to Generate the SQL string. If the query string is invalid, the violating rows will be highlighted red (indicating error) or yellow (indicating warning).
- Press the (Execute SQL Statement) button at the top of the window to execute the query string
- Select the **SQL View / Preview** tab to see the results of the query.
- Click **[Close]** to exit the Query Builder and click **[Yes]** when prompted to save changes

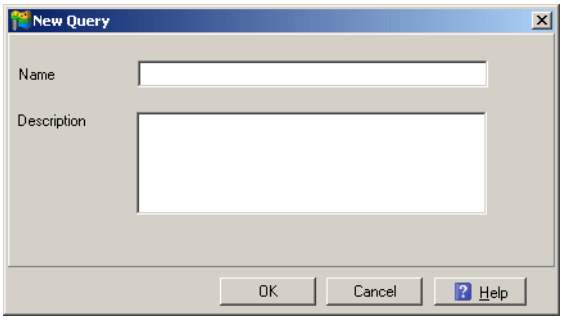
NOTE: For Data Queries, if aggregation options are selected, then the same fields in the **Display Fields** must also appear in the **Group By** options.

7.3.2 Station Group Query - Example

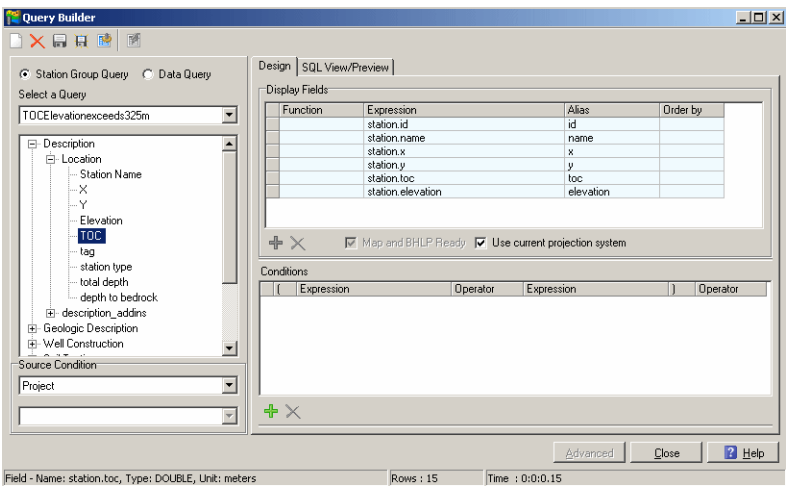
A Station Group query is used to segregate stations that meet specified criteria into a separate station group. The stations groups that are generated using a query are called “Dynamic” because the station compliment of these groups may change as new data is entered for the stations. The stations groups that are user defined are referred to as “Static” because they do not change unless the user makes the changes manually.

Follow the steps below to create a Station Group query.

- If the Query Builder is not yet loaded, select the **Query Builder** option from the **Tools** menu.
- Select **Station Group** Query as the type.
- In the toolbar, click on the (New) button.



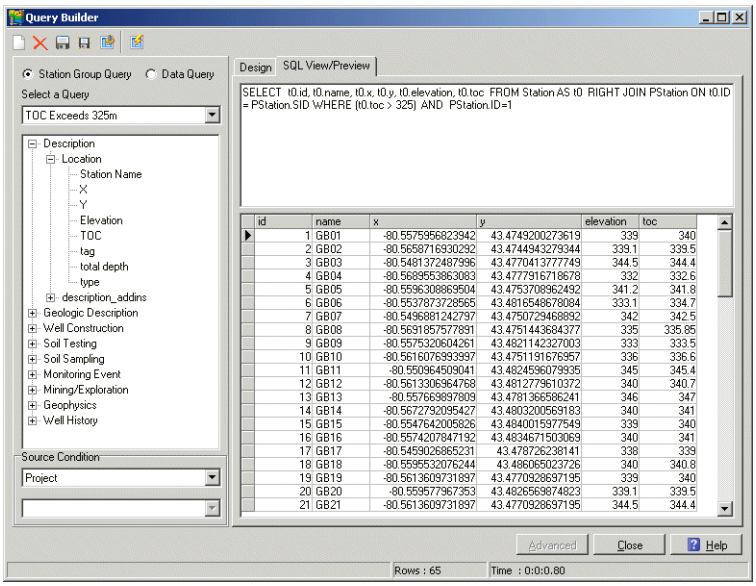
- In the dialog that appears, enter a **Name** for the new query (e.g. TOC Elevation Exceeds 325 m)
- In the lower-left corner of the Query window, select the **Source Conditions**. The options are **Station Group**, **Project,** and **Database**. If **Station Group** is selected, then the combo box below will become activated. From here, select the appropriate Station Group to query. If **Project** is selected, then all stations in the project will be queried. If **Database** is selected, then the query will be applied to the entire database.
- Expand the tree on the left side of the window.
- Locate the desired data category, table, and field. For this example, select the **Description** category, then the **Location** table, and locate the **TOC** field. An example is shown below:



- Click once on the field, and drag this field into the blank conditions field, under the **Expression** column. The selected field will be added automatically to the Query Conditions. (Alternately, you may use the (Add) button (on the bottom half of the window) to add conditions, then define them manually).
- Under the Conditions, select an **Operator** for the field. A combo-box with

several options will appear: >, >=, <=, <, =, LIKE, IS, IS NOT, etc. For this example, select **>.**

- Enter a value in the second **Expression** field. For this example, type **325**.
- Repeat this step for additional conditions. Link multiple conditions by specifying an additional Operator; choose from AND, OR.
- Press the (Generate SQL Statement) button at the top of the window to generate the SQL string. If the Query string is invalid, the violating rows will be highlighted red (indicating error) or yellow (indicating warning).
- Press the (Execute SQL Statement) button at the top of the window to execute the query string.
- Select the **SQL View / Preview** tab to see the results of the Query. The results of this query are shown in the window below:



- Press the (Save) button to save the query
- Press **[Close]** to return to the main HydroGeo Analyst window.

The new station group query will now appear as a new node under the **Station Group** node in the Project Browser. The stations group query (dynamic station group) can be distinguished from a user-defined station group (static station group) by a modified icon:

- Static

- Dynamic

NOTE: There are no options to modify the list of Display Fields for Station Group queries. The default display fields are: ID, Name, X, Y, Elevation, and TOC. In addition, there are no advanced options for Station Group queries.

7.3.3 Query Using SQL Commands - Example

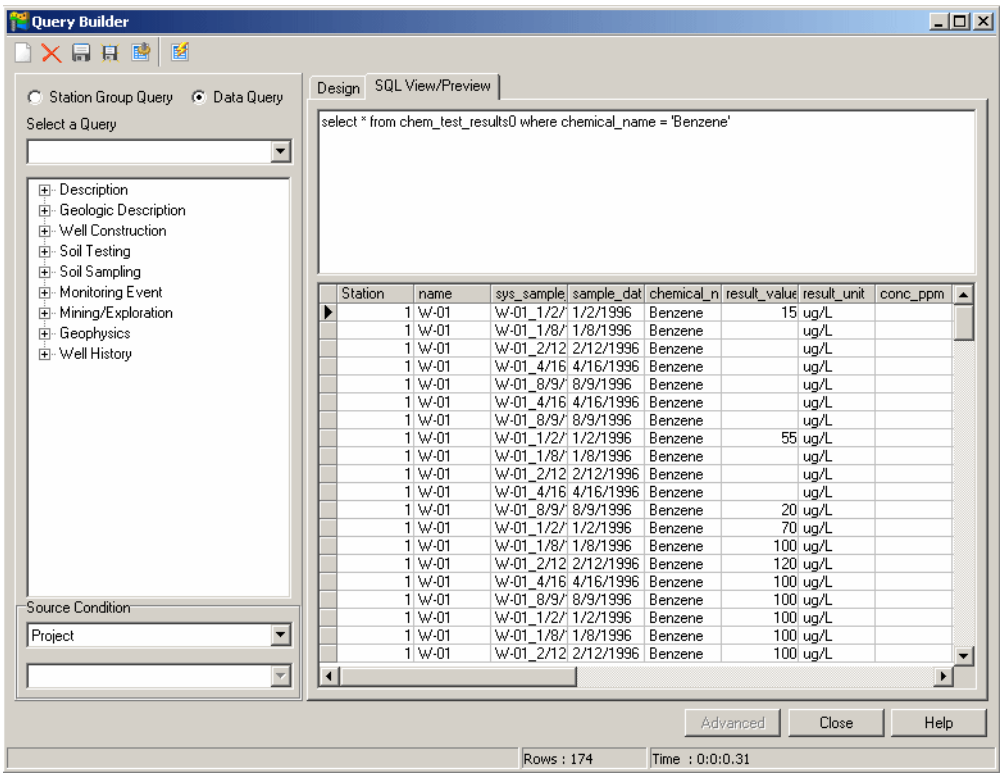
If you are familiar with Structured Query Language syntax commands, you can retrieve, manage and manipulate your data through the **SQL View/Preview** tab, using SQL statements. For example, two commands that are commonly used include the **Select** command and the **Delete** command. Both of these commands are described below.

Select Command

The **Select Command** retrieves data from tables in a database and is usually followed by a "where" clause. For example, if you want to create a query to show all chemistry results where the chemical name is benzene, you would enter the following SQL statement into the **SQL View/Preview** tab:

SELECT * FROM chem_test_results0 WHERE chemical_name = 'Benzene'

- Next, click the **Execute Query** button to display the query results (shown below).


Query Builder
Station Group Query
Data Query
Select a Query
Description
Geologic Description
Well Construction
Soil Testing
Soil Sampling
Monitoring Event
Mining/Exploration
Geophysics
Well History
Source Condition
Project
Design
SQL View/Preview
select * from chem_test_results0 where chemical_name = 'Benzene'
Station | name | sys_sample | sample_dat | chemical_n | result_value | result_unit | conc_ppm
1 | W-01 | W-01_1/2/ | 1/2/1996 | Benzene | 15 | ug/L
1 | W-01 | W-01_1/8/ | 1/8/1996 | Benzene | | ug/L
1 | W-01 | W-01_2/12 | 2/12/1996 | Benzene | | ug/L
1 | W-01 | W-01_4/16 | 4/16/1996 | Benzene | | ug/L
1 | W-01 | W-01_8/9/ | 8/9/1996 | Benzene | | ug/L
1 | W-01 | W-01_4/16 | 4/16/1996 | Benzene | | ug/L
1 | W-01 | W-01_8/9/ | 8/9/1996 | Benzene | | ug/L
1 | W-01 | W-01_1/2/ | 1/2/1996 | Benzene | 55 | ug/L
1 | W-01 | W-01_1/8/ | 1/8/1996 | Benzene | | ug/L
1 | W-01 | W-01_2/12 | 2/12/1996 | Benzene | | ug/L
1 | W-01 | W-01_4/16 | 4/16/1996 | Benzene | | ug/L
1 | W-01 | W-01_8/9/ | 8/9/1996 | Benzene | 20 | ug/L
1 | W-01 | W-01_1/2/ | 1/2/1996 | Benzene | 70 | ug/L
1 | W-01 | W-01_1/8/ | 1/8/1996 | Benzene | 100 | ug/L
1 | W-01 | W-01_2/12 | 2/12/1996 | Benzene | 120 | ug/L
1 | W-01 | W-01_4/16 | 4/16/1996 | Benzene | 100 | ug/L
1 | W-01 | W-01_8/9/ | 8/9/1996 | Benzene | 100 | ug/L
1 | W-01 | W-01_1/2/ | 1/2/1996 | Benzene | 100 | ug/L
1 | W-01 | W-01_1/8/ | 1/8/1996 | Benzene | 100 | ug/L
1 | W-01 | W-01_2/12 | 2/12/1996 | Benzene | 100 | ug/L
Advanced
Close
Help
Rows : 174
Time : 0:0:0.31

NOTE: The table names (e.g Chemistry Results) specified in the SQL statement must be entered as they appear in the database (e.g chem_test_results0). You can check the

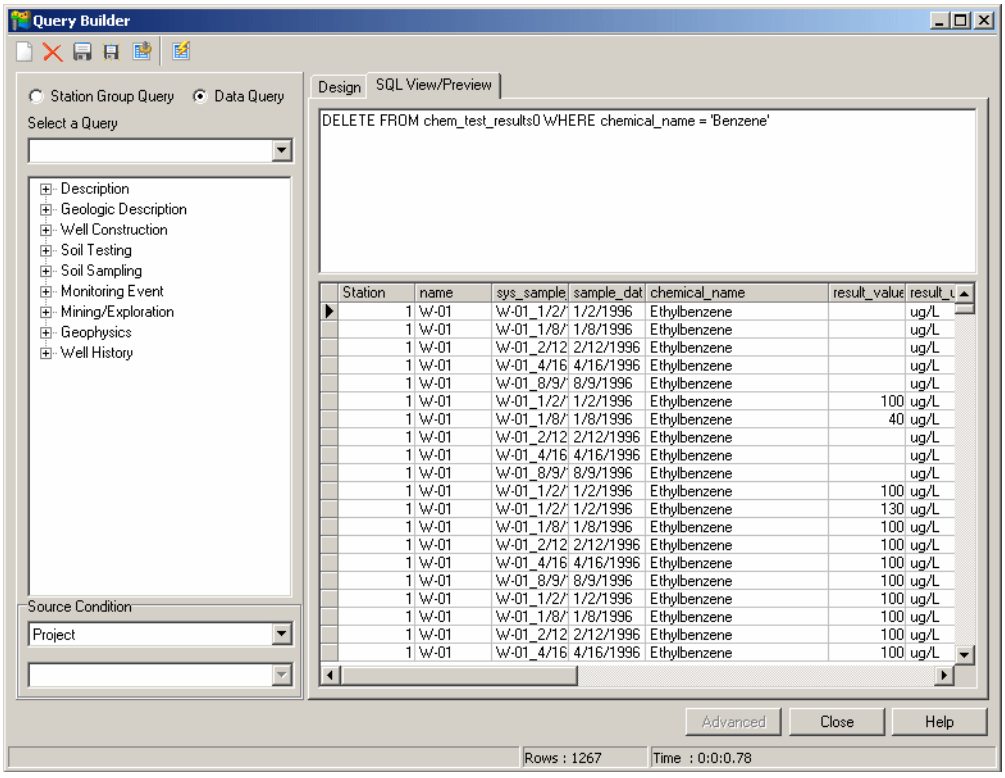
table names by referring to the Template Manager .

Delete Command

The **Delete Command** can be used to remove records from the database. For example, if you want to delete all records from the Chemistry Results table with the chemical name benzene, enter the following SQL statement into the **SQL View/Preview** tab:

DELETE FROM chem_test_results0 WHERE chemical_name = ‘Benzene’

- Next, click the **Execute Query** button to display the query results (shown below).



NOTE: Once you click the Execute Query button, all the data that is specified in the SQL statement will be permanently deleted from the database. Because there is no undo function, it is recommended that you use the select command before a delete command, to ensure that you have the selected the correct records.

The Delete command can also be executed through the “Data Query Tab” (page 238).

7.4 Managing Queries

After queries have been created, they may be easily modified, saved, or deleted within the Query Builder. As mentioned previously, once a query has been created, it will appear in the appropriate node in the Project Browser.

7.4.1 Editing

To quickly load a Data Query into the Query Builder, right-click on an existing query in the Project Browser (under the Queries node or Station Group node), and select **Edit** or **Edit (Dynamic)**.

Once in the Query Builder, make the necessary changes to the query, generate a new SQL statement, execute it, and Save.

7.4.2 Saving As...

One method of quickly creating multiple queries with similar conditions, is to use the **Save As** option, (press the (Save as) button in the toolbar). To do so, define all the necessary inputs for a query. Then, Save As the query under a new name. Then, simply make the required changes to the new query, and execute and Save. This is convenient for many cases. For example, if the only difference between the queries is in the Value field. (Query #1, find all stations where Vinyl Chloride > 10 ppm. Query #2, find all stations where Vinyl Chloride > 500 ppm). By duplicating the first query using the Save As option, the second query can quickly be created by making a small change to only the **Value** field.

7.5 Recalling Queries in HydroGeo Analyst

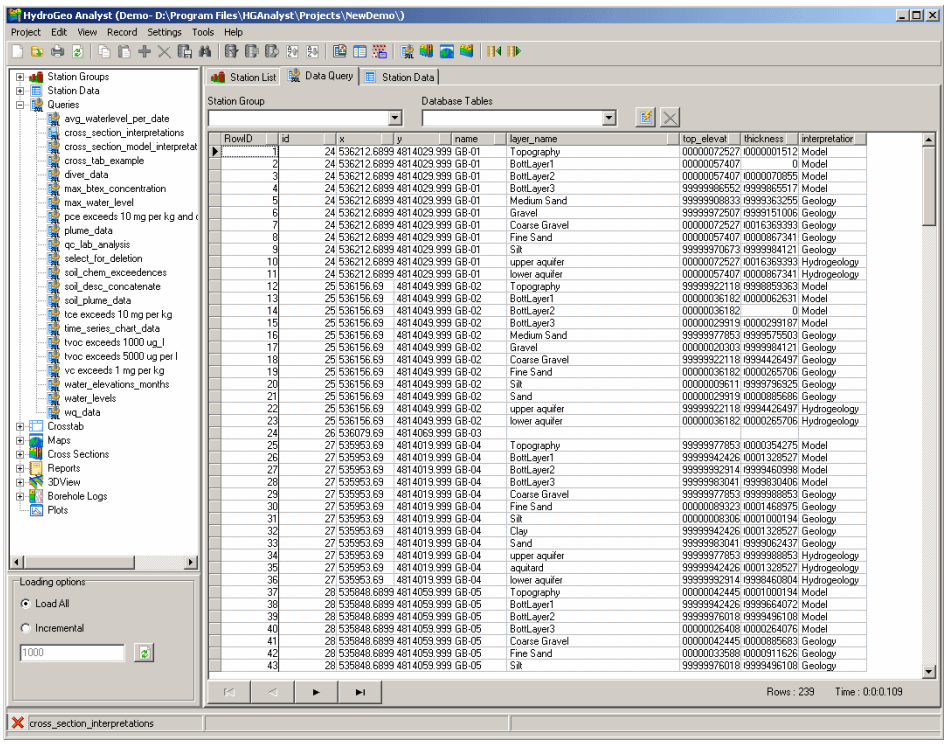
Once queries have been created, they will be available from the main HydroGeo Analyst interface.

A Station Group query will appear as a new branch under the Station Group node in the project browser. The stations which satisfy the query will be automatically added to this new Station Group.

A Data query will appear as a new branch under the Queries node in the project browser. To see the results of the selected query, right-click on the query and select **Execute** Query option. The query results will then be displayed in the **Data Query** tab, as described below.

7.5.1 Data Query Tab

The Data Query tab in the HydroGeo Analyst main window provides an interface for executing the queries and searches.



In the Data Query window, the following options are available:

To execute an existing query,

- Select the desired query from the **Queries** node in the tree
- Right-mouse click on this query, and select **Execute**

To see desired data from a selected table,

- Select a **Station Group** from the combo box, and any table from the **Database Tables** combo box
- Press the (Execute Query) button at the bottom of the window, and the grid will be populated with all records which satisfy this query. For example, select the Boreholes station group, and view all Lithology data that belong to this group.

In addition, through this interface, you may delete all records from a selected table. This is useful if you mistakenly import numerous records to the wrong table.

To delete records from a selected station group and table,

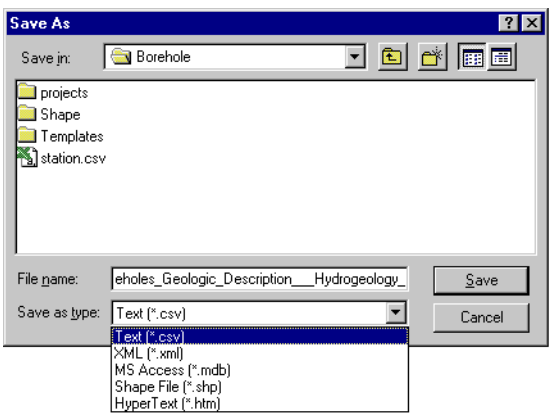
- Select a **Station Group** from the combo box, and any table from the **Database Tables** combo box
- Press the (Execute Query) button at the bottom of the window, and the grid will be populated with all records which satisfy this query.
- Press the (Delete) button.

Note: Use this feature with caution, as records will be permanently deleted from your database.

7.6 Exporting Query Results

Data Query results may also be sent to the Map Manager or to a Report. To load the results of a Data Query into a map project, select the **Record / Display on Map** menu option. To load the Data Query results grid into the Report Manager, see section 7.7 on page 239 below.

The data displayed in the grid may be exported to an external file, or to the Report Manager. Right mouse click on the grid and select **Export Grid**, or use the menu command **Project / Export / Grid** and the following dialog will appear.



Select the appropriate file format and enter a file name, then press **[Save].**

7.7 Printing Query Results

Using the WHI Report Editor, you may insert Query results into a report template, for fast and easy printing. To send the query results to the report editor:

- Select **Project / Report** from the main menu; or

- Click on the print button on the toolbar.

In the Reporting component, the query may be saved or printed.

For more information, please refer to Chapter 11: The Report Editor.

7.8 Crosstab Queries

7.8.1 Introduction

Crosstab queries are special types of queries that allow you to store your data in a normalized manner in your database, but generate and display pivoted, denormalized outputs from that data. In other words, crosstab queries let you format existing data queries, by rotating rows to columns to see different summaries of the source data for easier analysis and reporting.

Suppose you want to display a pivoted view of your chemistry results, whereby each row represents a different sample at each station, and each column represents results for each analyte. Another common example within the environmental industry is to show analyte names, reporting units, and regulatory limits along the left column, while sample names, date and/or depth ranges are shown along the top row, and result values and qualifiers shown in the intersecting cells. Storing your data in such a way in a table would break the first normal form, which disallows repeating groups. Crosstab queries provide a solution to this problem.

HydroGeo Analyst uses a state-of-the art crosstab component that is easy-to-use to produce dynamic crosstab queries and reports. The data in your crosstab reports can be highlighted with the format you specify, allowing you to flag values that are outside user-defined range values (for example above guideline levels). Once you are satisfied with the crosstab query you created, you may save the query for later use, send it to a printer, or export it to either an Excel spreadsheet, PDF or an HTML format. All formatting details will also be printed and/or exported.

7.8.2 Creating a Crosstab Query

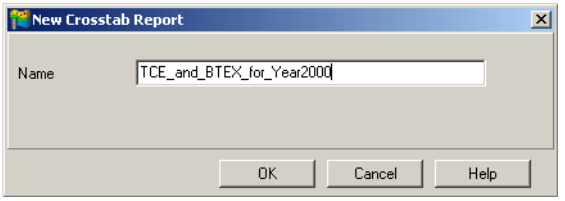
The crosstab query starts with a data query, which can be designed using the Query Builder. See “Data Query - Example” on page 222 for more details. The data query should contain the desired data set, along with the desired fields you want to display in crosstab format. For example, if you want to generate a crosstab report of groundwater chemistry results over time, at several stations, you may want to include the following fields:

- station name
- sample name or code
- screen location
- sample date
- chemical parameter(s)
- result value (concentration)
- units
- method detection limit

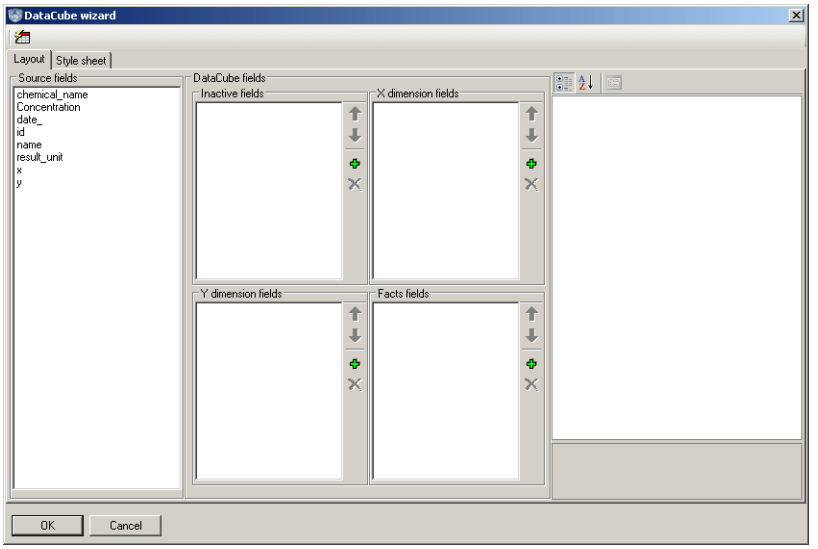
Once you have created a data query, you are ready to create a Crosstab query. This can be done in several ways:

- Select the desired Data Query from the **Queries** node in the HGA project browser, then select **Tools / Crosstab Report** from the main menu; or
- *Right*-mouse click on the Data Query, and select **Crosstab Report** from the pop-up menu.

A dialog will appear prompting you for a name for the Crosstab report; enter a name then click **[OK]**.



The **DataCube Wizard** window will then open, as shown in the following screenshot:



The **DataCube Wizard** window contains two tabs with options that can be configured.

- **Layout**: Select which fields from your data query should be used in the crosstab report.
- **Style Sheet**: Specify the style settings for the crosstab report.

Each tab is described in detail below.

Layout

The layout tab consists of a **Source field** list which contains all the fields from your data query. There are also four DataCube fields: **Inactive Fields**, **X dimension Fields** (rows), **Y dimension fields** (columns) and **Facts fields.**

X Dimension Fields are the fields selected from a data source or created by a user for column dimension formation

Y Dimension Fields are the fields selected from the source field list or created by the user for row dimension formation

Facts fields are those fields that will be used to produce the values in the pivot table cells. Fact fields can be selected from the source field list or created by the user.

Inactive fields will appear as headers in your crosstab report, but will not affect pivot table formation. Use these headers to apply filters to your crosstab data.

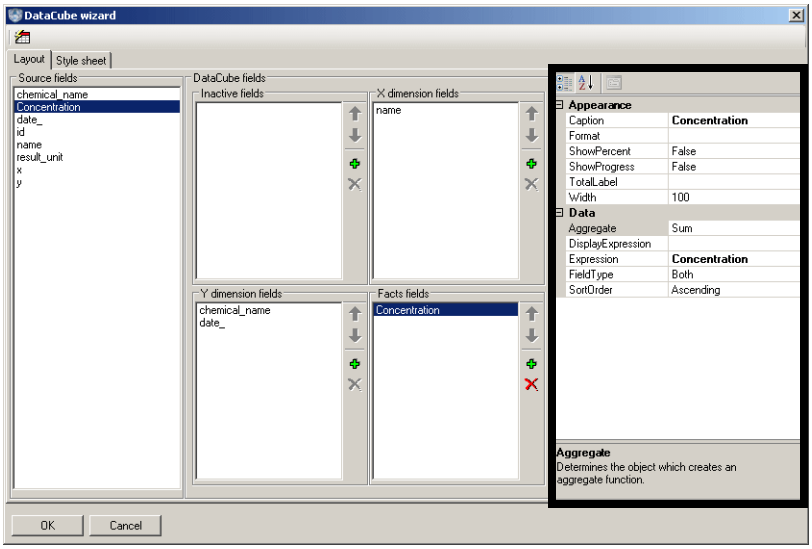
You can organize the crosstab report by dragging fields from the **Source field** list and dropping them into the **DataCube fields**, where they will appear in the view at runtime. Multiple source fields can be added to any frame.

You can modify each field list, using the following buttons:

- Move a field **up** one position in the list
- Move a field **down** one position in the list
- **Add** a field to the list
- **Delete** a field from the list

Field Property Editor

You can change the properties of each field, using the **Field Property Editor** (shown below). By default, the editor is divided into two sections: **Appearance** and **Data**. You can organize the settings in **Alphabetical Order** by selecting .



Each property is described below:

Caption: Change the caption of a field item.

Format: Assign a field data output format string. For example, you can use this property to specify the number of decimal places to show (e.g. Type 0.00 to show values to two decimal places).

ShowPercent: Show field data as percent.

ShowProgress: Represent field data as a progress bar for each cell. In order to set this property, the ShowPercent property must be enabled.

Total Label: Assign a header for a field total.

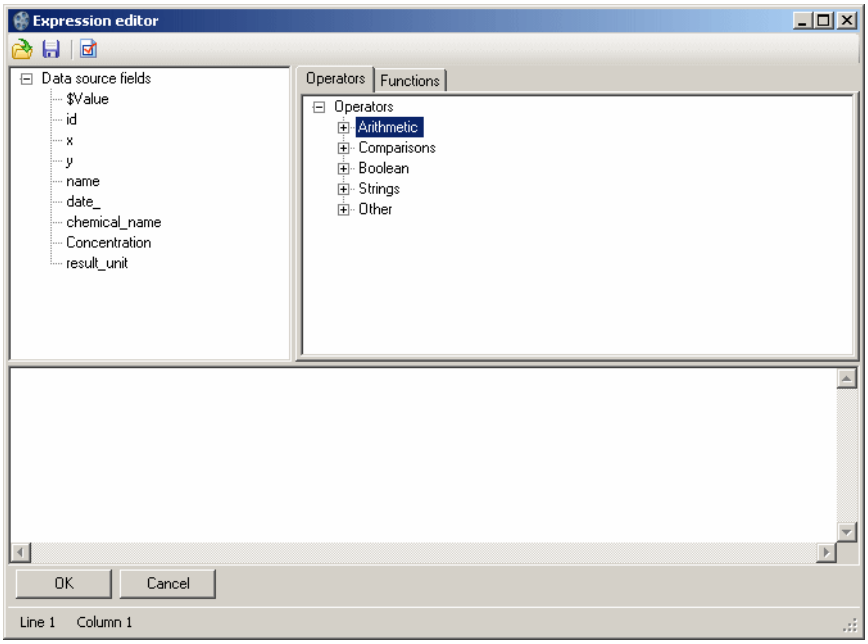
Width: Change the cell width of the field.

Aggregate: Assign a data aggregation type for a field. This property only applies to the Fact fields. The following aggregation types are available: Sum, Count, Min, Max, Avg, Standard Deviation, Estimate of Standard Deviation, Variance, Estimate of Variance, Median, Skewness, Kurtosis.

DisplayExpression: Use the **Expression Editor** (shown below) to create an expression property for a field header.

Expression: Use the **Expression Editor** to create an expression property for a field.

Expression Editor



The **Expression Editor** allows you to construct logical and arithmetic expressions for determining values for both facts fields and dimension fields, in your cross-tab report.

The editor provides a list of source fields from the data query, and various **Operators** and mathematical **Functions**. You can define the expression by simply arranging the source fields and operators/functions into the space below, using the drag-and-drop with the mouse.

Once the expression has been defined, click **[Ok]**.

The following buttons are available in the Expression editor.

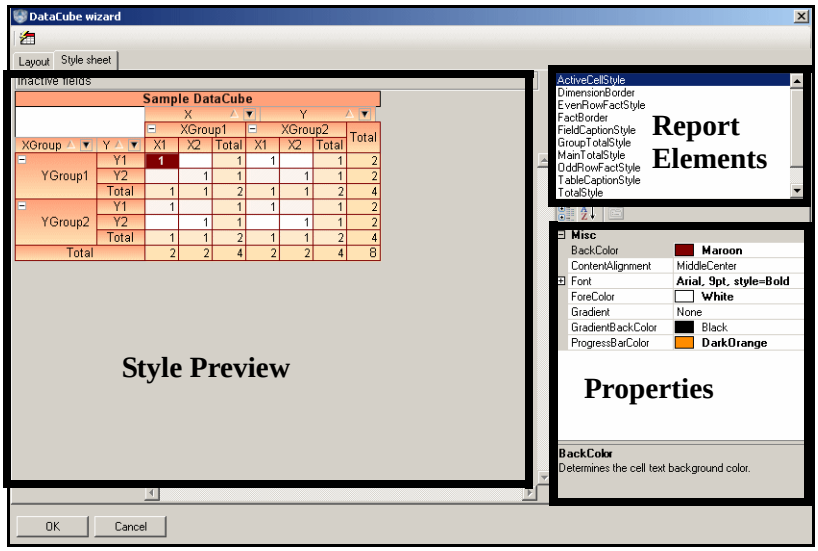
- **Check Expression:** Use this button to **Verify** that the expression does not contain any syntax errors.
- **Open Expression**: Use this button to **Open** an existing expression from a text file.
- **Save Expression:** Use this button to **Save** an expression in text file format.

FieldType: Assign a field type to a field. Choose from **Fact Only, Dimension only** and **Both.**

SortOrder: Assign a field data sorting order. Choose from **Ascending or Descending.**

Style Sheet

The **Style Sheet** tab in the **DataCube wizard** allows you to define the appearance properties for the crosstab report.



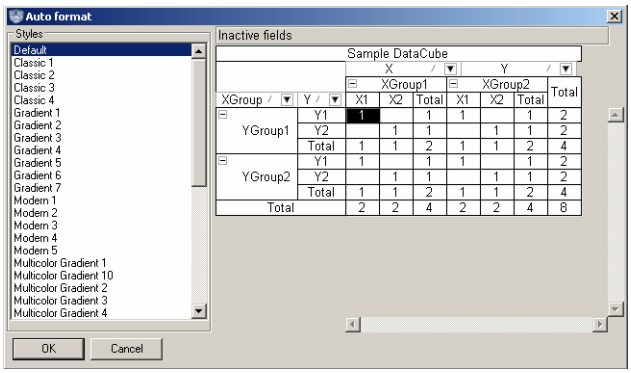
The **Report Elements** list contains all the report elements that can be customized. The **Properties** dialog is context sensitive and allows you to change the appearance properties for the selected report element. The changes made will then be shown in the **Style Preview** frame.

Click **[Ok]** to accept the style settings.

Auto Format

The crosstab component contains a variety of color scheme templates that can be applied to your crosstab report. To access the color scheme templates, open the **Auto Format** dialog (shown below) by clicking on the **Auto Format** button , located above the Layout tab.

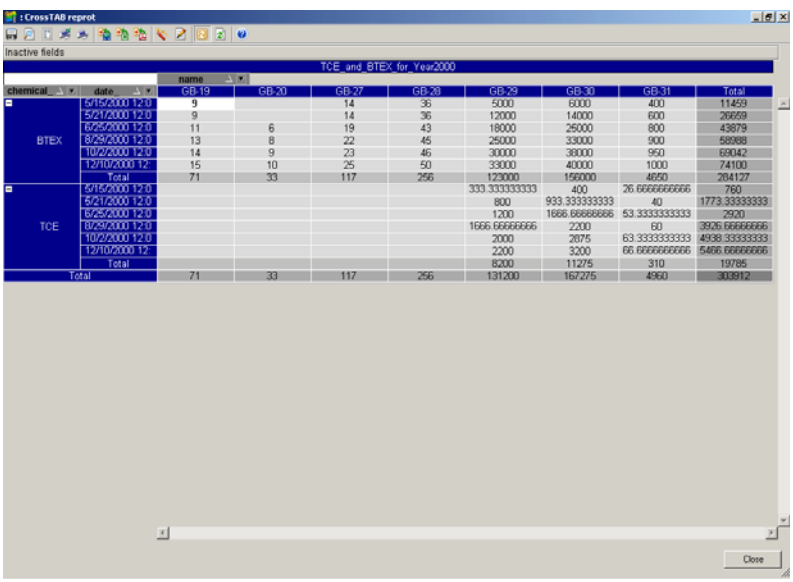
Here you can select a color scheme template from the **Styles** list and preview its properties.



Once you have selected a template, click **[Ok]** to apply the template to your crosstab report.

7.8.3 Generating the Report

Once the layout and style settings have been defined, click the **[OK]** button in the DataCube Wizard dialog to generate the report. A table will be generated with the query results, as shown in the following screenshot:



At the top of the crosstab results table window, there is a toolbar with several buttons that control options for editing, printing, exporting, and modifying the display properties of the query. Each button is described below:

- Use the button to save the crosstab report.
- Use the button to print preview the report.
- Use the button to define the page settings.
- Use the button to set the printing options.
- Use the button to print the crosstab report.
- Use the button to export the report to an HTML file. A dialog will appear, where you can specify a directory and filename for the .HTML file.
- Use the button to export the report to an MS Excel file. A dialog will appear, where you can specify a directory and filename for the .XLS file.
- Use the to export the report to an PDF file. A dialog will appear, where you can define the page and export settings, and the filename for the .PDF file.

Note: HTML, Excel and PDF export features do not support gradient coloring. As a result, report elements that contain a gradient appearance will export as a solid color.

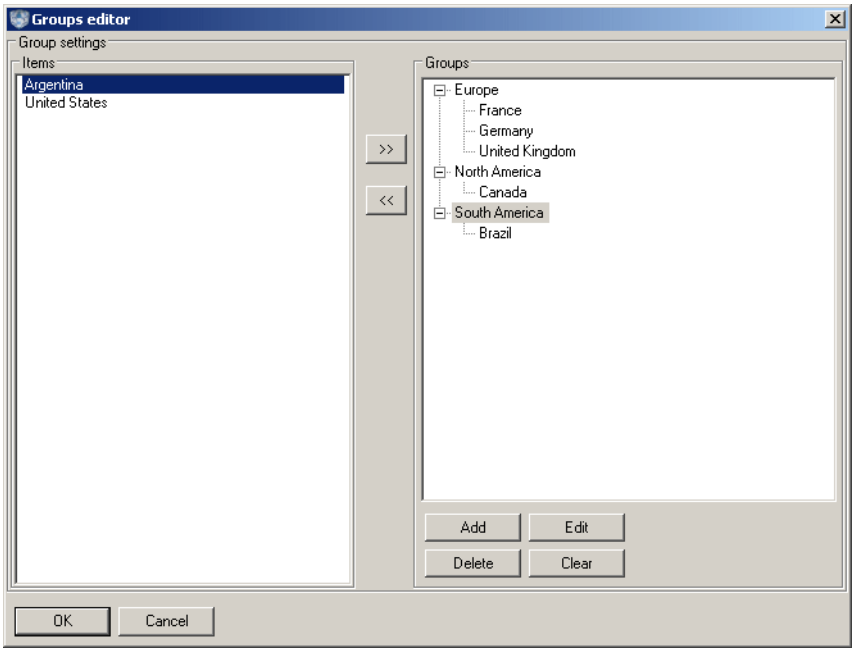
- Use the button to open the DataCube Wizard. Here you can modify the crosstab query format and style, as described in the previous section.
- Use the button to define/modify data markers for the data points. See “Data Marker Settings” on page 251 for more details.
- Enable the button to have the crosstab report automatically refresh when changes are made to the format or style.
- Use the button to manually refresh the crosstab report when the automatic refresh is disabled, and changes are made to the format or style.
- Use the button to access the electronic help document.

The Crosstab results window provides flexible management of the columns and fields.

- Click on the + button to expand the full results
- Click on the - button to collapse the view, for an overview of the results.
- Using conventional drag-and-drop, you can shift columns to the left or right, or rows up or down, or move fields from rows into columns, or from columns into rows.
- Right-click on a field header to access additional options. These options are contextual and affect only the field that was selected.
  - **Accent** - Sort results in ascending order
  - **Decent** - Sort results in descending order
  - **Collapse All** - Collapse the view
  - **Expand All** - Expand the view
  - **Align Field Width** - Automatically align a field width to the widest display value within the field.
  - **Move to facts** - Move a field into facts
  - **Move to rows** - Move a field into the rows dimension
  - **Move to columns** - Move a field into columns dimension
  - **Move to ignore** - Ungroup a field from pivot table calculation.
  - **Group settings** - Open the Groups Editor widow (see below).

Groups Editor

The **Groups Editor** window (shown below) allows you to combine multiple field items, and display them as a single field item in the cross tab report. For example, if your crosstab report contains a “countries” field, you may wish to group its field items by continent (e.g. North America, Europe, South America etc.).



To create a group,

- Click the **Add** button to insert a new group item. The group item will appear as a tree node under the **Groups** frame. Here you can specify a group name.
- From the **Items** frame, select a field item and click the **[>>]** button to add the field item to the group. Similarly, you can use the **[<<]** button to remove an item from a group. **Note:** A field item can only belong to one group.

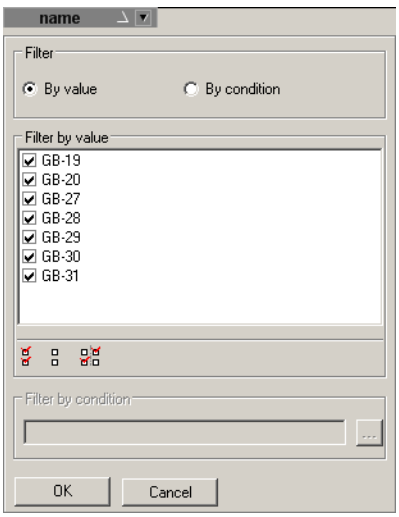
The **[Edit]** button allows you to modify the name of a selected group. Use the **[Delete]** button to remove a group from the groups list. Clicking the **[Clear]** button will remove all groups from the groups list.

Once the groups have been defined, select **[Ok]**.

Crosstab Table Display Settings

You may show/hide data from the crosstab report, using tools built into the crosstab component. Each data field that is displayed as a row or column, includes this functionality. Click on the button beside the field, and you will see options similar

to those shown below:



For each data field, you will see the results returned. In the example above, the query returned seven instances of station name, but if the selected field was chemical names, then you would see all the chemical names that are included in the data query results.

You can show/hide data from the selected field, using one of two methods: **By Value** or **By Condition**. Each method is described below.

Filter By Value

When this filter option is selected, you can manually specify which field values to show/hide by selecting/unselecting the desired value checkboxes. The following buttons are available:

Select all field values

Unselect all field values

Invert selected field values

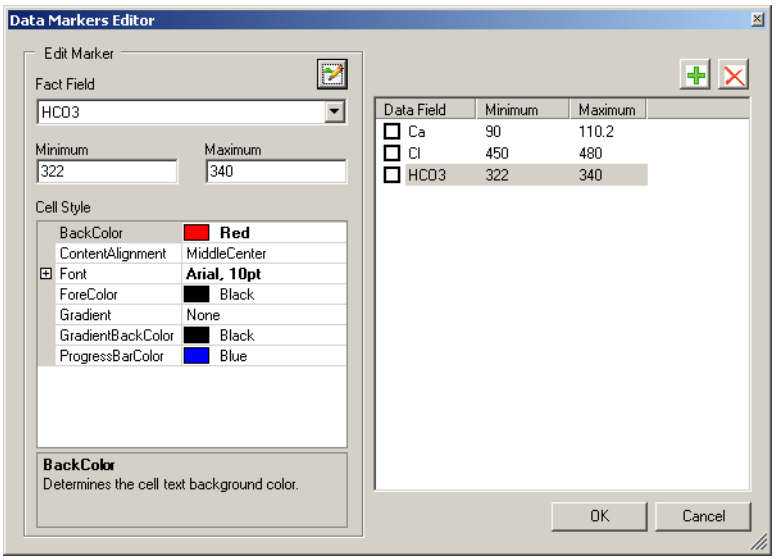
Filter by Condition

When this filter option is selected, the **Filter by Condition** frame will become active. Here you can access the **Expression Editor** by clicking on the ... button. Within the Expression Editor, define a filter condition. For example, this method would be useful for a Date field when you would like to only show the dates that fall within a particular time period (e.g between Jan 1 and June 1). Please see “Expression Editor” on page 245 for more information on using the Expression Editor.

Once the filter settings have been defined, click **[Ok]** to apply them to your crosstab report.

Data Marker Settings

- Use the button to load the **Data Markers Editor**, where you can highlight data in the crosstab report.



In the **Data Markers Editor** window, there are several options available for setting the display properties of data fields, and defining colors for conditions.

Click the (Add) button to add a condition. Next, define the condition and specify the color scheme in the following fields:

- **Fact Field**: select a data field from the list.
- **Minimum**: define a value for the lower limit
- **Maximum**: define a value for the upper limit
- **Cell Style:** define the display properties for the condition, including the BackColor, Alignment, Font Styles, ForeColor, Gradient Style, GradientBack Color and Progress Bar Color.

When you have defined the settings, press the **Apply Changes** button.

To delete an existing condition, simply select the appropriate row in the table, and click on the (Delete) button.

When you are finished, click on the **[OK]** button.

The values should then be colored accordingly in the crosstab report.

Edit Value Markers

To edit a value marker, simply double-click on the desired item from the list of markers. Now you may make changes to the cell style properties or the Min/Max values.

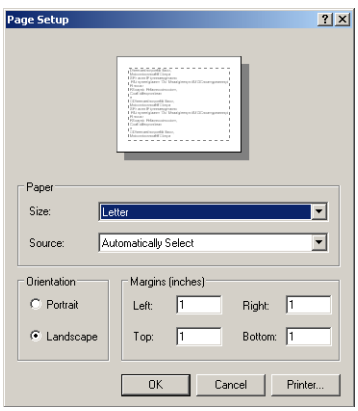
Once the changes have been made, click the **Apply Changes** button.

7.8.4 Printing Crosstab Reports

Crosstab reports can be easily printed directly from the crosstab component. Before printing, you may want to first define the page and print settings. These settings are described below.

Page Settings

From the report window, click the **Page Setup** button to open the page setup dialog (shown below).

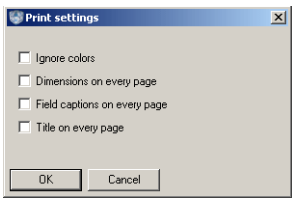


Here you can define the **paper size**, **paper source**, **page margins** and **page orientation**.

Once these settings are defined, click the **[Ok]** button to return to the report window.

Print Settings

From the Report window toolbar, click the **Print Options** button to open the Print Settings dialog (shown below).



The following options are available:

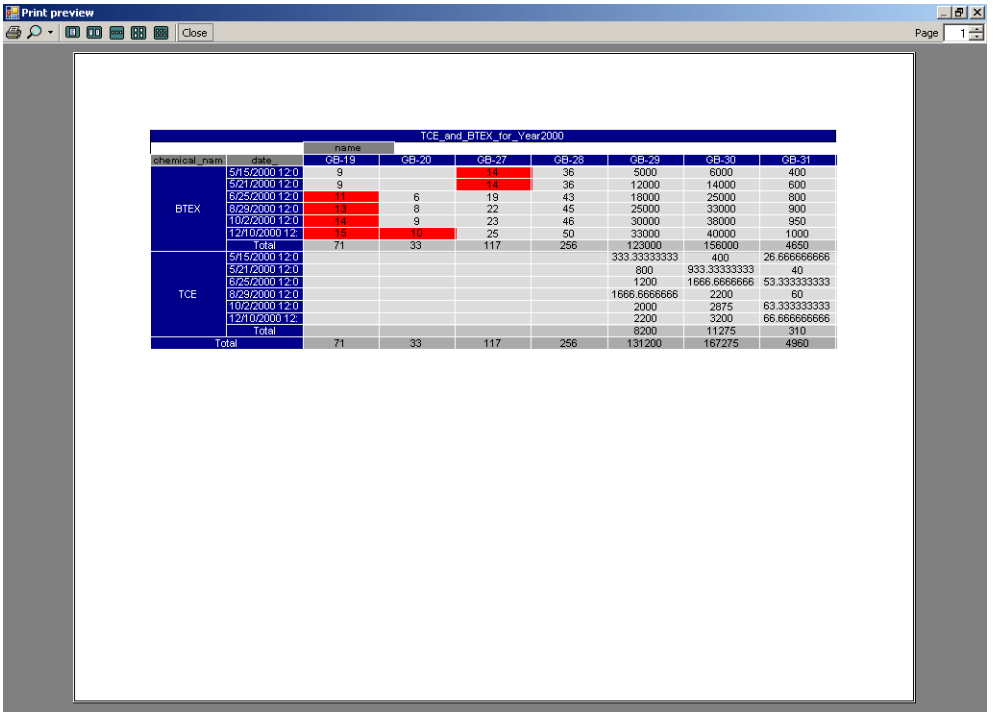
- **Ignore Colors**: Show/Hide report color scheme. If selected, the report will print in grey-scale.
- **Dimensions on every page:** Show/Hide row and column headings on all pages after the first page.
- **Field captions on every page:** Show/Hide field captions on all pages after the first page.
- **Title on every page:** Show/Hide report title on all pages after the first page.

Click **[OK]** to save the settings and return to the report window.

Print Preview

Finally, you can preview the page settings for your crosstab report using Print Preview.

From the report window, click the **Print Preview** button to the open the preview window (shown below).



The Print Preview window contains a toolbar that allows you to modify the view settings. The following buttons are available:

- Use the button to print directly from the Print Preview window.
- Use the button to zoom in and zoom out of the Print Preview window.
- Use the button to view just one page
- Use the button to view two pages at once
- Use the button to view three pages at once
- Use the button to view four pages at once
- Use the button to view six pages at once

You can scroll through the pages, using the **Page** vertical scroll bars, located in the top-right corner of the print preview window.

Click **[Close]** from the Toolbar to return to the Report window.

Printing Report

To send your report to a printer, click on the **Print** button.

8

Map Manager

The GIS Map Manager is built on ESRI™ Map Objects technology and is packed with an abundance of GIS mapping features that seamlessly connect your project maps with the HydroGeo Analyst database. However, the GIS Map Manager goes far beyond simple mapping, it also acts as a fundamental source for producing cross-sections, accessing borehole logs and well construction details, and developing contour maps (elevations, concentrations, water table, etc.). The GIS Map Manager is an integral part of HydroGeo Analyst and is ideally suited for analyzing and presenting the spatial orientation of your groundwater or borehole project data.

Some of the key features of the Map Manager are listed below

- Import vector maps into a map project
- Import BaseMap Layers to the Map Project (DXF, Raster and Shapefile formats), including high resolution MrSid image files.
- Georeference and import raster image maps
- Display Station Groups or Data Queries from the HydroGeo Analyst project as a Map Layer in the Map Project
- Edit map layers (labels, order, style, visibility)
- Draw and edit a point, line, polygon, or text on a map with Annotation tools
- Create contour, color shade and zebra maps of a desired data set
- Create Thematic Maps: Bar and Pie Charts of selected fields
- Select stations using a rectangle, polygon, circle, line, or a single point
- Create new station groups with stations selected in the map project
- Send a Map view to the Report Editor
- Export Map view as Raster images
- Create a legend for the Map Project
- Turn layers on/off and set their properties using Layer Manager
- Define locations for cross section lines
- View statistics for selected data or station group layers (Min, Max, Sum, Standard Deviation, Mean)
- Label and symbol renderer allows for creating color ramps, gradients, shading, etc., based on specified station data
- Line measurement tool allows for measuring the distance between two points on the map project

8.1 About the Interface

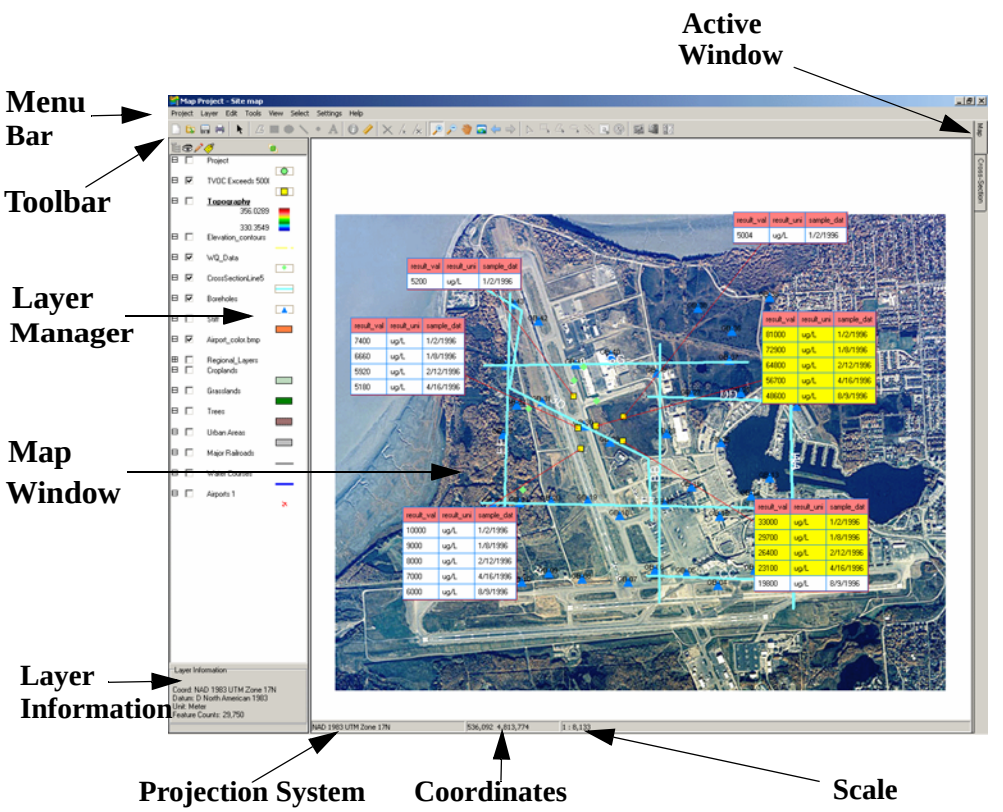
Map projects are created and modified within the Map Manager application linked to HydroGeo Analyst. The Map Manager can view and modify one map project at a time. In addition, the map projects should be modified by only one user at a time.

A map project may have an unlimited number of map layers.

The Map Manager may be loaded from HydroGeo Analyst in several ways:

- Select **Tools / Map Manager** from the Main Menu of HydroGeo Analyst;
- Select **Record / Display on Map**, and the selected HydroGeo Analyst records will be loaded onto a Map project;
- In the HydroGeo Analyst toolbar, click on the (Map) button;
- From the HydroGeo Analyst Project Browser, select a map project branch from the **Map** node.

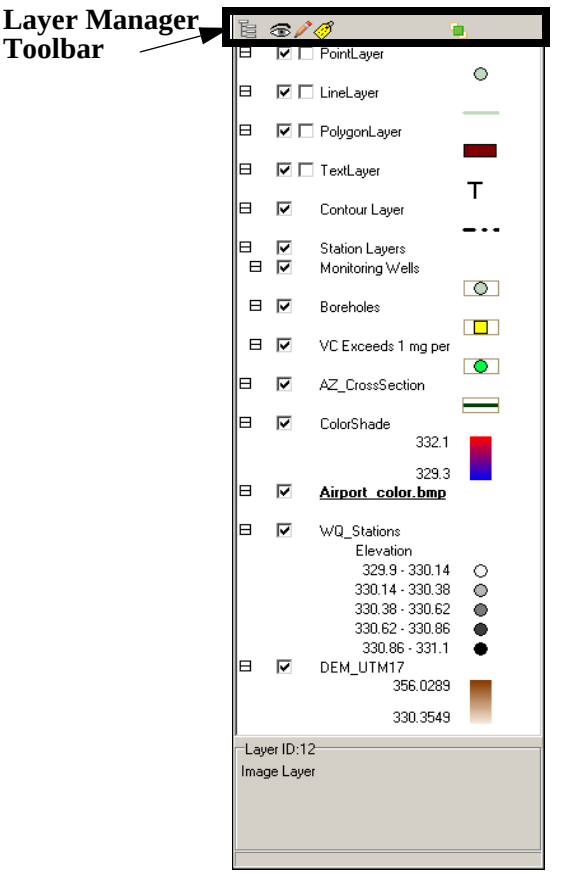
Once the Map Manager window is loaded, the display should be similar to the one shown below.



The Map Manager window contains the following elements:

- **Menu Bar**: Contains program menu commands
- **Toolbar**: Contains short cut buttons to some of the most commonly used features in the Map Manager
- **Layer Manager**: Manages activating a layer, visualizing, and/or editing layers.
- **Map Window**: Contains the visible layers for the map project.
- **Layer Information:** Displays the system for the selected layer.
- **Coordinates**: Displays the X,Y coordinates for the current mouse cursor location, and the Map Projection system.
- **Scale:** Displays the scale for the map window.
- **Active Window:** Select between the Map Manager window and the Cross Section Editor window.

The **Layer Manager** allows you to manage the layers in the map project. The icons at the top of the Layer Manager provide some insight into the functionality.



These features include:

- **Group Control**: Expand and collapse group layers.
- **Visible**: Set the visibility status of the selected layer.
- **Editable**: Make the selected layer editable (or not) by checking (or unchecking) the check box. Currently, only those shapefiles created in the Map Manager are editable.
- **Label**: Displays the Layer name.
- **Symbol**: Edit the symbol identifying the layer on the map.

The Layer Manager will contain numerous types of layers, each represented by a different symbol type. In the example shown here, the layer types, from top to bottom, are as follows

- **PointLayer:** Point shapefile, represented by a point symbol. These include station groups and data query layers imported into the map project.

- **LineLayer:** A line symbol indicates a cross-section line, contour line layer, or annotation line
- **PolygonLayer:** Polygon shapefile, represented by a polygon symbol
- **TextLayer:** Text annotation layer, represented by a T symbol
- **Contour Layer:** Contour line layer
- **Station Layers:** A **group layer** containing several component layers
  - **Boreholes and Monitoring Wells:** Station group layers
  - **vc_exceeds_1 mg per:** A data query
- **CrossSectionLine2:** Cross section line layer
- **Color Shade:** A color shade layer
- **Airport_color.bmp:** Georeferenced raster image
- **WQ Stations:** A station group layer with **graduated rendering**
- **DEM_UTM17:** A surface (DEM) layer

Grouping Layers

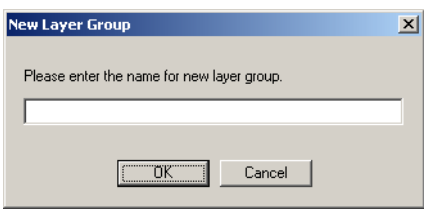
Group Layers help organize map layers that share similar characteristics, in a map project. For example, if your map contains a railroad layer and a highway layer, you may choose to group these layers into a single group layer called Transportation Network.

Group Layers behave similarly to other layers within the Layer Manager panel. If you turn off the visibility for a group layer, the component layers will also turn off. You can also move a group layer up or down the layer list, change its draw order and ungroup layers as needed.

Creating a Group Layer

To create a Layer Group, follow the steps below:

- Right-click anywhere within the Layer Manager panel.
- From the pop-up menu, select **Create Layer Group**.



- Enter a name for the layer group.
- Click **[Ok]**

The new layer group will now appear in the Layer Manager panel.

Adding Layers to a Group

To add a layer to a layer group, simply drag and drop the desired layer onto the layer group.

Removing Layers from a Group

To remove a layer from a layer group, simply drag and drop the desired layer out of the layer group.

Removing Layer Groups

To remove a layer group, follow the steps below:

- Right-click on the desired layer group.
- From the pop-up menu, select **Delete.**
- The component layers will ungroup and return to the root of the layer list.

All layer types, including layer groups, can be **moved up** and **down** within the Layer Manager panel, by simply dragging and dropping the layer into a new position.

8.1.1 Description of Toolbar Items

The toolbar in the Map Manager provides access to most of the same features available in the Main Menu. Most toolbar buttons are context sensitive, and react according to the active layer, window, or dialog. If there are no options for the selected layer, the respective toolbar button(s) will become inactive, indicated by a “greyed-out” appearance.

New button creates a new map project.

Open button opens an existing map project.

Save button saves the current map project.

Print button sends the current map view to the report editor.

Selection Pointer button allows objects in the active layer to be selected.

Draw Polygon button allows a polygon to be drawn in the active layer. This feature is active only when a polygon shapefile layer is selected and set to be editable.

Draw Rectangle button allows a rectangle to be drawn in the selected layer.

This feature is active only when a polygon shapefile layer is visible and set to be editable.

Draw Circle button allows a circle to be drawn in the selected layer. This feature is active only when a polygon shapefile layer is selected and set to be editable.

Draw Line button allows a line to be drawn in the selected layer. This feature is active only when a line shapefile layer is selected and set to be editable.

Draw a Point button allows a point to be inserted in the selected layer. This feature is active only when a point shapefile layer is selected and set to be editable.

Insert Text button allows for text to be inserted on the selected layer. This feature is active only when a text file layer is selected and set to be editable.

Information button allows the information for the selected station, or any other object such as contour lines, to be viewed.

Measure button allows the distance between two points on the map to be measured.

Delete Selected Object button allows the selected object (polygon, rectangle, circle, line, point, or text) to be deleted from the active layer. This feature is active only when an object is selected.

Add Vertex button allows a vertex to be added to the selected object (polygon, rectangle, circle, or line). This feature is active only when an applicable object type is selected.

Delete Vertex button allows a vertex to be deleted from the selected object (polygon, rectangle, circle, or line). This feature is active only when an applicable object type is selected.

Zoom In button allows zooming in on the map window. Draw a rectangle in any direction around the area you wish to zoom in to.

Zoom Out button allows zooming out from the map window.

Pan button allows panning the current map view left, right, up, or down.

Full Extent button restores the map view to the full extent of the map's coordinates.

Previous Extent button allows restoring the map view to the previous zoom extent.

Next Extent button advances the map view to the next zoom extent.

Select Single button allows individual objects such as stations to be selected. This feature is active only when a layer containing HydroGeo Analyst stations is visible, and selected from the Layer Manager.

Select In Rectangle button allows selecting all stations within a rectangle that is drawn by the user. This feature is active only when a layer containing HydroGeo Analyst stations is visible, and selected from the Layer Manager.

Select In Polygon button allows selecting all stations within a polygon that is drawn by the user. This feature is active only when a layer containing HydroGeo Analyst stations is visible, and selected from the Layer Manager.

Select In Ellipse button allows for selecting all stations within an ellipse that is drawn by the user. This feature is active only when a layer containing HydroGeo Analyst stations is visible, and selected from the Layer Manager.

Select Along Line button allows for selecting all stations within a buffer distance of a line that is drawn by the user. This feature is active only when a layer containing HydroGeo Analyst stations is visible, and selected from the Layer Manager.

Select All button selects all stations in the current map layer. This feature is active only when a layer containing HydroGeo Analyst stations is visible, and selected from the Layer Manager.

Select None button de-selects all stations in the current map layer. This feature is active only when a layer containing HydroGeo Analyst stations is visible, and selected from the Layer Manager, and at least one station has been

selected.

Cross Section Line button allows the location and buffer distance for cross section lines to be defined. This feature is active only when a layer containing HydroGeo Analyst stations is visible, and selected from the Layer Manager.

Show/Create Cross Section button allows a cross-section corresponding to a selected cross-section line on the map to be created or viewed. This feature is active only after a cross section line has been selected or drawn in the map window.

BHLP button loads a Borehole Log Plot (BHLP) for the selected station.

8.2 Description of Menu Items

8.2.1 Project

New

The New item provides options for creating a new map project file. Map projects are saved with the extension *.VMP in the project sub-directory “Map”. The new map project will use the same projection system and extents as defined in the current HydroGeo Analyst project.

NOTE: Each Map Project has required fields which must be present in your database structure, as defined in the Profile Settings. For more details, see Chapter 5: Profile Settings.

Open

Provides options for opening an existing Map Project; only files with the (*.VMP) extension can be opened using the Map Manager.

Save

Provides an option to save the current map project file. All current Map Layers that are displayed will be saved to the current Map Project file.

Save As

Provides the option to save a copy of the current Map Project with a different name.

Close

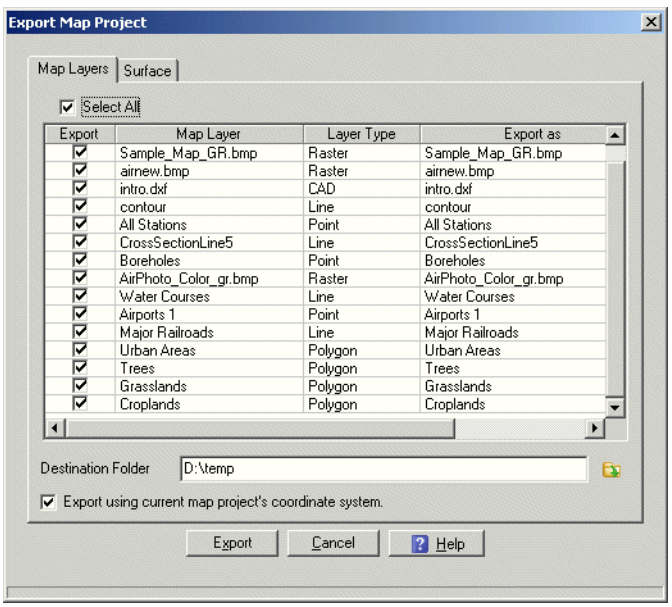
This will close the current Map Project. If there are unsaved edits, there will be a prompt to save changes before closing.

Reopen

A list of recently accessed map projects will be displayed beside the Reopen item. This is an alternate method of opening map project files, instead of using the Open command.

Export Project

Creates a copy of all layers in the current map project, for use in other applications.



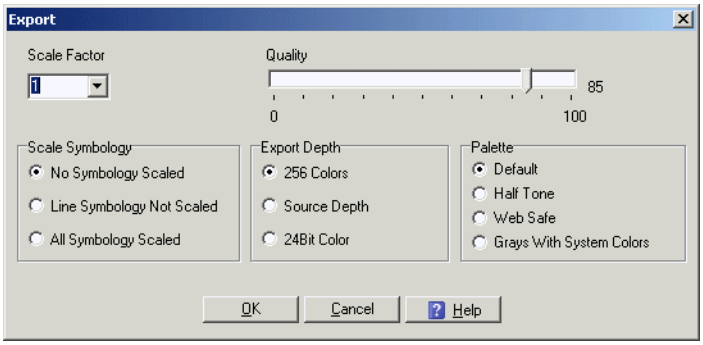
In this dialog, select the layers you with to export, and define names for the layers; the same can be done for Surfaces (if any are available). Finally, specify the Destination Folder for the copy of the map files.

On exporting a map project, selected shapefiles will be exported in the current projection system if selected by the user. Raster images will use the projection system at the time the image was georeferenced.

Export Map

Provides options for exporting the current map view to a Raster Image file. Supported file types include: Bitmaps (*.BMP), JPEGs (*.jpg), and Enhanced Meta Files

(*.EMF). Enter a filename, and choose the file format, and click Save. An Export dialog will appear with settings for the image file, as shown in the following figure:



There are several options for modifying the image:

Scale Factor: Choose a scale factor from the combo box. This factor will determine the resolution of the exported image. The greater the factor the better the resolution will be.

Quality: Using the scroll bar, define the image quality. This option is available only if the JPEG export format is selected. The greater the percentage the higher the quality will be. The image size is also directly proportional to this value.

Scale Symbology: Determines if the scale factor will be applied to symbols and lines.

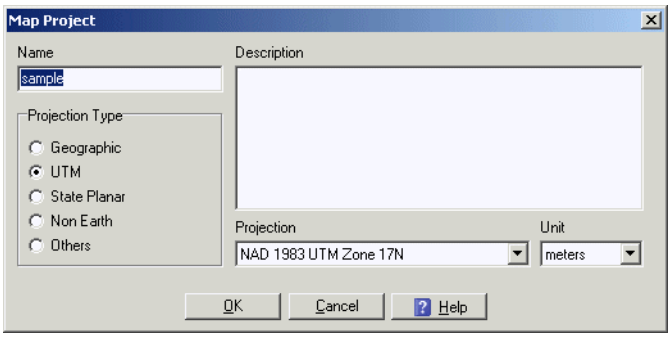
Export Depth: Choose the color quality for the exported image.

Palette: Determines the color palette to be applied to the exported image.

The Palette and Color Depth options are available only for bitmaps (*.BMP) and enhanced Meta File (*.EMF).

Properties

The Map Project Properties dialog contains general settings for the map project. This dialog is shown below:



In this dialog, there are options for editing the Projection System, units, and description.

- In the **Name** field, a new name may be defined for the map project.
- In the **Projection Type** frame, there will be a list of Projection Systems supported by Map Manager and stored in the Database. For each Projection Type, a **Projection** must be defined, along with a corresponding **Unit**. The default unit for each projection will be displayed.
- In the **Description** text box, you may define a brief description of the project.

NOTE: Projects in the Map Manager can use co-ordinate systems that differ from those used for displaying stations in the main HGA window.

Print

Loads the map view into the Report Editor, where the report may be printed and/or saved for later retrieval. For more information please see Chapter 11: The Report Editor.

Exit

Exit the Map Manager and return to HydroGeo Analyst.

8.2.2 Layer

A Map Layer is a set of points, lines, polygons or a raster image that have geographic coordinates attached to it. A Map Layer may be imported into any Map Project.

New

Provides options for creating a new map layer. A new layer may be created as one of the following file types:

- ESRI Polygon shapefile (*.shp)
- ESRI Line shapefile (*.shp)
- ESRI Point shapefile (*.shp)
- ESRI Text shapefile (*.shp)

These are **Annotation Layers**, meaning that they can be used to draw various shapes or labels (text) on your map project.

The new map layer will use the projection system of the current map project. After entering a filename for the layer, the new map layer will be created, then placed in the Layer Manager and added to the current Map Window.

HINT: For easy maintenance, it is suggested that the shapefiles be kept in the same folder as the current map project. By default, Map projects are created in the **Map** sub-folder of the current **Project** folder.

Open

Shapefile

Provides options for opening a map layer. The Map Manager is able to open any shapefile that has a projection system already assigned to it. These shapefiles include all types of ESRI shapefiles (polygons, lines, points, and text). Once a map layer is opened, it will appear in the Layer Manager, and is added to the current Map Window.

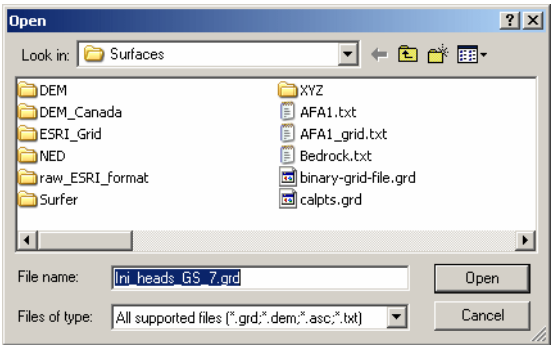
If the shapefile is not in the same projection datum as the map project, the Map Manager will transform its coordinates based on the defined geotransformation settings. To define the geotransformation settings go to **Settings \ Config Geotransformation**. Please See “Config Geotransformations” on page 310.

Surface

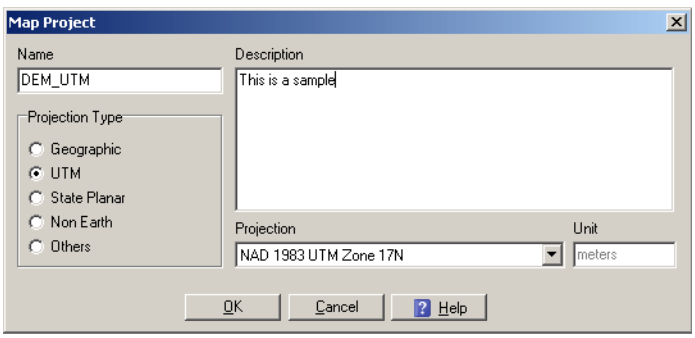
Provides options for importing 3D surface layers. The following surface files are supported:

- Surfer grid (.grd) version 6 and 7
- DEM (.DEM)
- ESRI ASCII (.asc)
- Text (.txt)

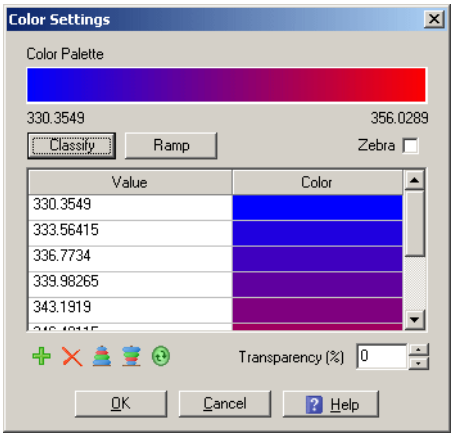
Upon selecting this option, an **Open** dialog will display (shown below).



Locate and select a surface file, and select **[Open]**. The following dialog will display where you can specify a **Name**, **Projection Type**, **Projection system** and **Description**. The surface projection system must be the same as the projection system defined for the Map Project. For example, if your Map Project is set to the NAD83 projection system, you must select NAD83 for the surface layer.

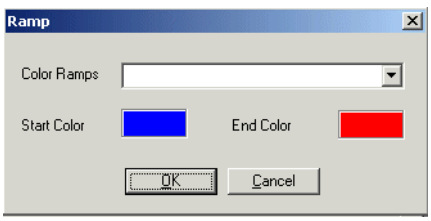


Once the surface layer settings have been defined, click **[Ok]**. The **Color Settings** dialog (shown below) will appear.



The **Color Settings** dialog allows you to define different colored zones/ranges according to their specific interval of elevation values.

- The **[Classify]** button allows you to decide how many intervals you wish to have, and HGA automatically divides the available range of values into that number of equal intervals.
- The **[Ramp]** option loads the following dialog.



You can choose a monochromatic ramp that provides a range of the same color, but with varying degrees of darkness, a dichromatic ramp that provides a spectrum between two different colors, or a custom ramp by choosing colors for the **Start Color** and **End Color** boxes (to load the color dialogue, click on the colored box).

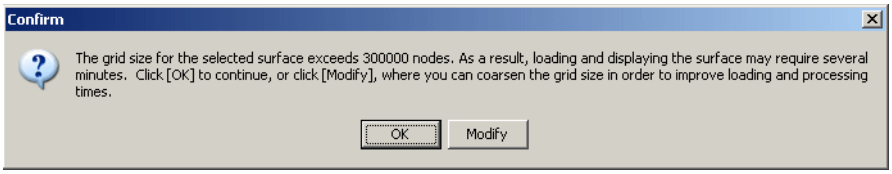
Click **[OK]** to return to the renderer screen.

Alternatively, you may set the color for each value; simply click on the Color box under the Color column, and the Windows Color palette will display. Select the desired color, and click **[OK]** to continue. Repeat this for other values, as desired.

Adjust the **Transparency** option to make it possible to see layers under the color shading/zones. The higher the value, the more transparent the layer will be. The value must be within the range 0-100.

To display the value intervals in discrete color zones, rather than continuous shading, select the **Zebra** checkbox.

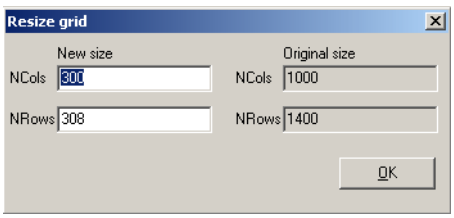
Once the color settings have been defined, click the **[Ok]** button.


Confirm
The grid size for the selected surface exceeds 300000 nodes. As a result, loading and displaying the surface may require several minutes. Click [OK] to continue, or click [Modify], where you can coarsen the grid size in order to improve loading and processing times.
OK
Modify

A surface file with a large grid size may take several minutes to load depending on the performance capabilities of your computer. For example, a DEM surface file that is approximately 9mb, may take up to 10 minutes to load.

If the grid size for the selected surface file exceeds 300,000 nodes, the message shown above will display, and you can choose to accept the original grid size or modify its dimensions to lower the resolution and decrease the loading time.

To accept the original grid size, click **[Ok]**. Otherwise, click the **[Modify]** button to specify a new grid size. The following dialog will be shown:



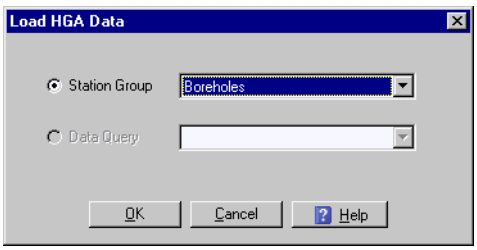
The **NCols** and **NRows** fields represent the number of columns and number of rows for the surface file, respectively. These fields will contain recommended values for the new grid size. However, you can manually define a new grid size by entering the desired values for these fields.

Click **[Ok]** once the new grid size has been defined.

The surface layer will then be generated and added to the Layer Manager panel.

Load HGA Data

This menu item provides options for loading HydroGeo Analyst data as a new map layer. The data source may be a list of stations from a HydroGeo Analyst Station Group or those resulting from a Data Query. Upon clicking on this menu item, the following dialog will appear:



In this dialog, select the data source type and choose (from the appropriate combo box), the desired **Station Group** or **Data Query**. The data will be used to create a new Map Layer, and the layer will be displayed in the Layer Manager as well as in the map window. This option is available only if a map project is open. The resulting shapefiles will be saved as follows:

- for Station groups, the shapefiles (and supporting files), will be saved to the sub-directory Map\Selection
- for Data Queries, the shapefiles (and supporting files), will be saved to the sub-directory Map\Data

Import

This menu item provides options for importing basemap layers to the current Map Project. Basemap images may be Raster Images (*.sid, *.bil, *.tif, *grc, *.bmp, *.jpg, *.tga), AutoCAD files (*.dwg, *.dxf), or MicroStation files (*.dgn). Each format is explained below.

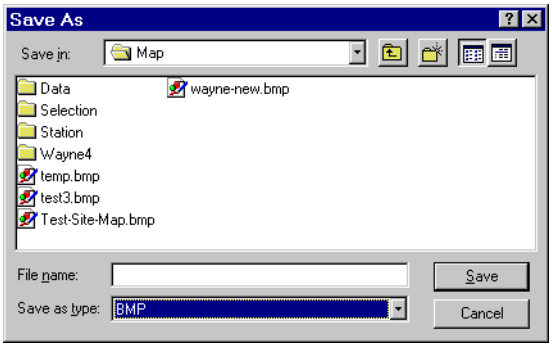
Raster Image

A critical element of any Map Project is registering the image map with the correct real world coordinates. This procedure is called Georeferencing. Since raster images do not contain information on the site's projection system or length units, these details must be manually added using Georeferencing. Georeferencing assigns points with known coordinates to the image; the image is then scaled and the map extents are calculated.

NOTE: The Map Manager does not provide an error trap for invalid georeferencing points.

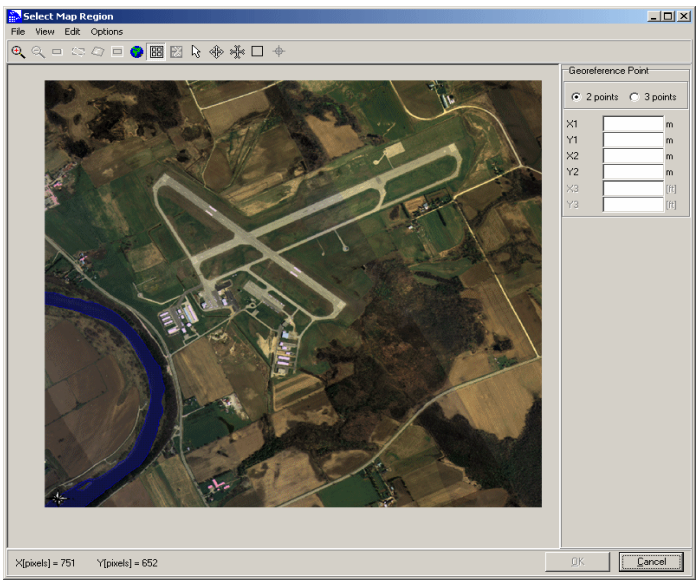
Georeferencing Raster Images

If a **Raster** image is selected from the **Layer / Import** menu, a message will appear stating that the image must be georeferenced. Click **[Yes]** to continue, and you will be prompted to save the georeferenced image as a new file:



Enter a name for the new image. The file will be converted and saved as a bitmap (*.BMP). This new name will be used as the map layer name in the Map Manager.

Click **[Save]** to continue, and the **Georeference** window will appear as shown in the following figure.



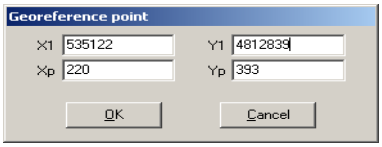
In order to map the pixels of the image to a coordinate system, the image must have **at least** two georeference points with known coordinates. These georeference points can be defined using the procedure described below.

Note: The real world georeference points must have coordinates that are in the same projection system as the Map Project. Map Manager will not make adjustments or conversions for georeference coordinates that are in a different projection system.

To set a georeference point,

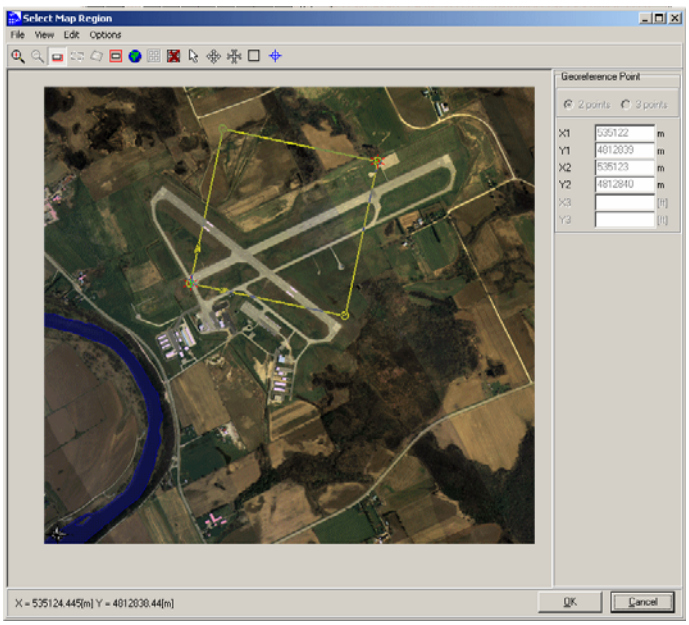
- Click on the first map location where the X and Y world coordinates are

known. A **Georeference point** dialog will appear prompting for the X1 and Y1 world coordinates of the selected location:



- Enter the **X1** and **Y1** coordinates for this point.
- Click **[OK]**
- Click on the second map location where the world coordinates are known.
- Enter the **X2** and **Y2** coordinates for this point.
- Click **[OK]**

A box will appear around the map region, similar to the window shown below.



The Georeference utility will convert the Raster Image to project coordinates; in the top right corner of the window, the two **Georeference Points** will be displayed. These values cannot be modified unless one of the georeference points is deleted and a new georeference point is assigned.

A box will appear in the map window, defining the image corners. The image region can be modified as explained below.

To delete a georeference point,

- Click the (Delete Point) button in the toolbar
- Select one of the georeference points to delete it.

NOTE: When a georeference point is deleted, a new georeference point must be added, since two georeference points are required to create a coordinate system.

Once the Georeference points have been defined, the map region may be modified. In the **Select Map Region** window, the map region is represented by an outline of a box with circular nodes at each corner and with arrows pointing along the X and Y axes. The map region box can be shifted or expanded to any alignment on the site map using the toolbar options described below. These options may also be accessed from the **Options** menu on the Main Menu bar.

Resize Region Click-and-drag a corner of the map region box to stretch or shrink the size of the map region. The new map coordinates will be updated to display the new map region.

Rotate Region Rotate the map region

Align Rectangle Align the map region with the x-axis.

Maximize Enlarge the map region to the full extents of the basemap.

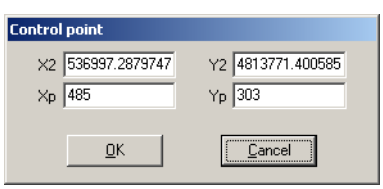
- **HINT**: If it is desirable to use the entire image for the map, use the Maximize option to expand the map region to the full extents.

Adding Control Points

You can validate the accuracy of the georeferenced raster, by using **Control Points**. Control points are simply locations on the raster image of which real-world coordinates are known. Real-world coordinates can be derived from geographic sources such as topographical maps or GPS units. By comparing the georeferenced raster coordinates with their corresponding real-world coordinates, you can determine if the raster has been georeferenced accurately.

To add a control point,

- Click the button from the toolbar.
- Click a location on the raster image where the real-world coordinates are known. A dialog similar to the one shown below will display.

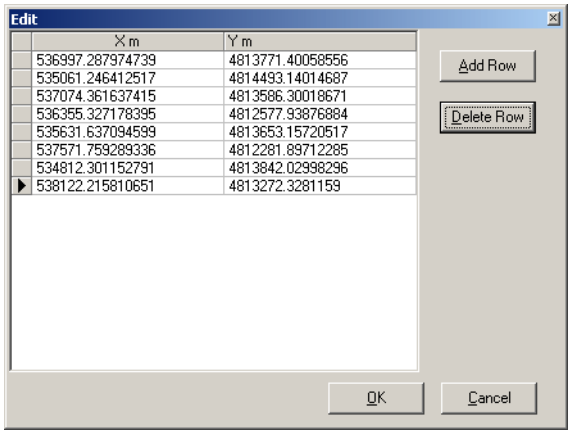


- Coordinates shown in the above dialog (X2, Y2) represent the interpolated coordinates derived from the two or three specified georeference points, for that particular location on the image. You can validate the accuracy of these

coordinates by comparing them to the real-world coordinates of that location. **Note**: To improve precision, you may want to **Zoom In** directly on the location, before adding the control point.

- Click **[Ok]** to accept the Control point. You can add additional control points by simply clicking on a different location on the raster image.

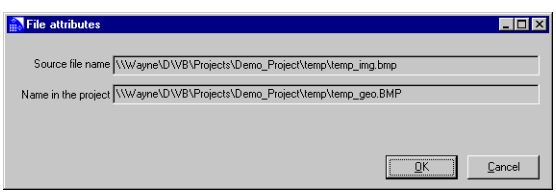
All control points are stored in a table (shown below) which can be accessed by clicking **Edit / Control Points** from the menu bar**.**



Here you can review all of the control points. To delete a control point, simply click the appropriate row in the table and click the **[Delete Row]** button. Click **[Ok]** to close the table.

If there is a significant difference between the georeferenced coordinates and real-world coordinates, check the precision of the georeference points, and reassign if necessary.

Once the georeferencing is completed, click **[OK]** in the Georeference window. A confirmation dialog will appear as shown below:



Click **[OK]** to continue. The Raster Image will then appear as a new Map Layer in the Map Project.

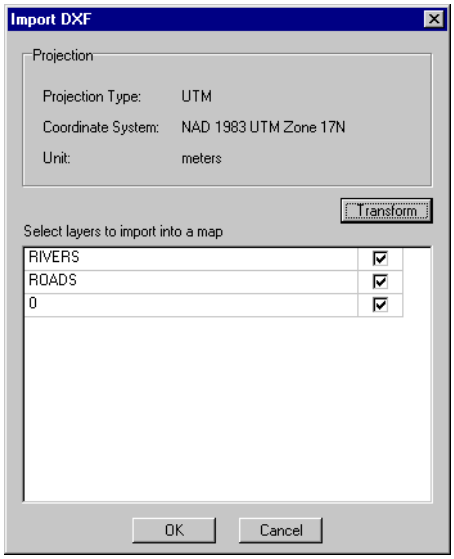
CAD

The Map Manager also allows you to import CAD files into a map project file. Supported formats include AutoCAD files (*.DXF, *.DWG), and MicroStation files (*.DGN). CAD layers may be built in a Projection that is different from that used for the current map project; therefore, when a CAD file is selected, the projection system and units may need to be converted to the current projection system and units. In addition, CAD files may contain graphic features on different layers; as such, there are options to select the layer to import. These options are explained below.

HINT: If you are having difficulties importing your CAD drawing please try exploding all blocks and re-saving as a dxf file before attempting to import into HGA.

Selecting Layers

When a **CAD** format is selected using the **Layer / Import** menu, navigate to the appropriate file and open it. The following dialogue will load:



The top portion of the dialogue lists the projection system properties of the current map project. Below this frame is a [Transform] button. This option is required only if you are not sure that the CAD file has the same projection system as the current map project. In this case, click **[Transform]** to georeference the CAD image. Once you are done, click **[OK]** to return to the Import DXF dialogue.

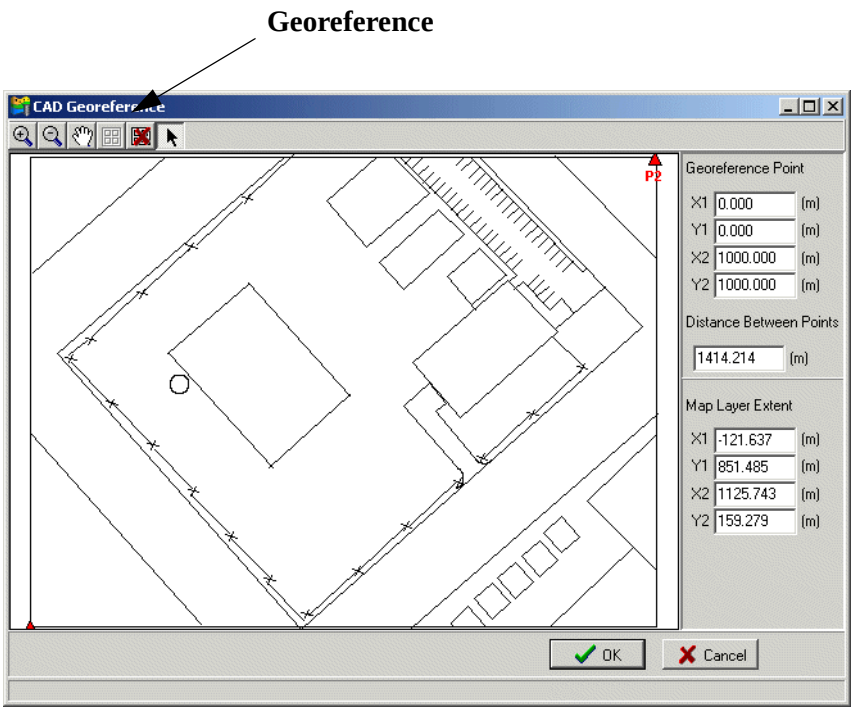
In this dialogue, select which layers you wish to import into the map and click **[OK]**.

Transforming Coordinates

The CAD file must contain the same units and projection system as the current map project in order for it to be displayed properly. If there are differences, then the CAD

file can be Transformed to the map project's projection and coordinate system.

From the Import DXF dialog, click on the **[Transform]** button. This will launch the **Map Georeference** window as shown below.

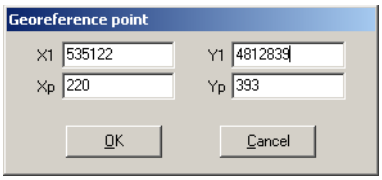


Transformation is performed using two points on the DXF file, with known coordinates. The Map Manager does not provide an error trap for invalid transformations.

Follow the procedure below to import a DXF file, and use the coordinate Transformation option:

To set the georeference point, click the **Georeference** button

- Click on the first map location where the world coordinates are known. A **Georeference point** dialog will appear prompting for the X1 and Y1 world coordinates of the selected location:



- Enter the **X1** and **Y1** coordinates for this point.
- Click **[OK]**
- Click the **Georeference** button again
- Click on the second map location where the world coordinates are known.
- Enter the **X2** and **Y2** coordinates for this point.
- Click **[OK]**

The coordinates will be entered into the corresponding Georeference fields on the right-hand side of the window.

Once this is complete, click **[OK]** to continue, and the CAD file will be loaded as a new layer into the map project.

Save

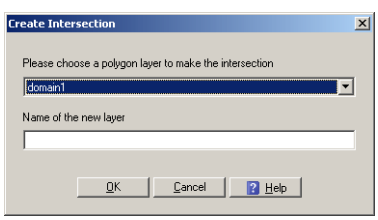
Saves the selected layer.

Delete

Deletes the selected layer. A layer cannot be deleted while it is in Edit mode.

Create Intersection

With this option, you create a new map layer from the intersection of any station (points), polyline, or polygon layer, with another polygon layer. The following dialog will appear:

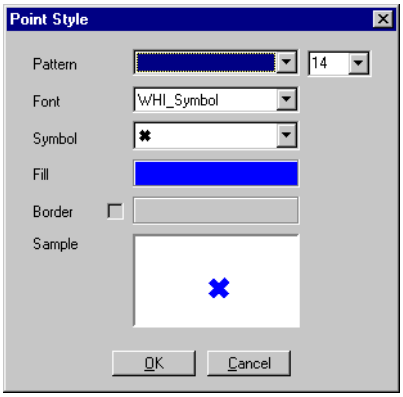


Select the desired layer, and enter a name for the new layer. Click **[OK]** when you are finished, and the new layer will be added to the Layer Manager panel.

Properties

Provides options for modifying the symbol for the shapes (point, line, polygon) on the

current (active) layer in the Layer Manager. The options dialog is shown below:

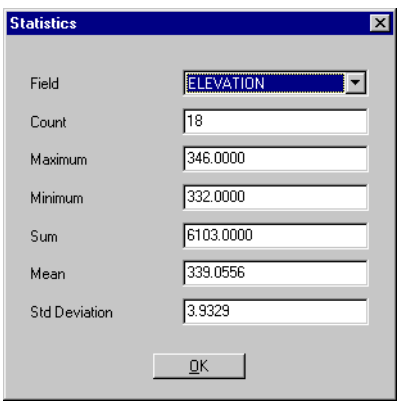


The dialog shown here is for point shapes. There are similar dialogs for line and polygon shapes.

The available symbol **Patterns** include circle, square, triangle, cross or any symbol from all true type fonts that may be available on your system. If the latter is selected, you will have to select the desired font from the **Font** combo box and the desired symbol from the **Symbol** combo box. Choose a symbol size from the combo box in the upper right corner. Finally, the symbol **Fill** color may be chosen from a color palette. If a border around the symbol is desired, select the check box beside **Border** and provide a border color.

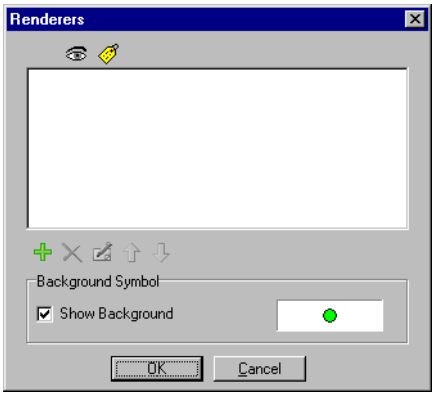
Statistics

Displays statistics for the selected data field of a selected layer. These include: Count, Maximum, Minimum, Sum, Mean, and Standard Deviation, as shown in the figure below.

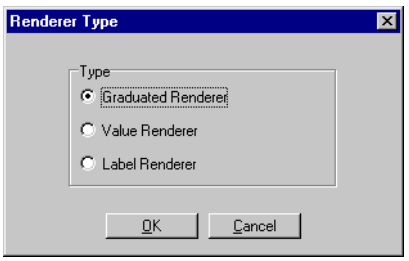


Renderer

Provides options for a Map Renderer. The Map Renderer allows assigning labels to objects on the map layers.



A new Renderer may be added by clicking on the (Add) button. The following dialog will appear with the available Renderers from which you can select.



- The **Graduated Renderer** provides a way of classifying features into categories or classes, by drawing different symbols for features based on numeric attribute values and their ranges.
- The **Value Renderer** provides a means of representing features of a map layer by drawing a symbol for each unique data value.
- The **Label Renderer**: can be used to display labels on contour maps, or to place labels on stations or any other object.

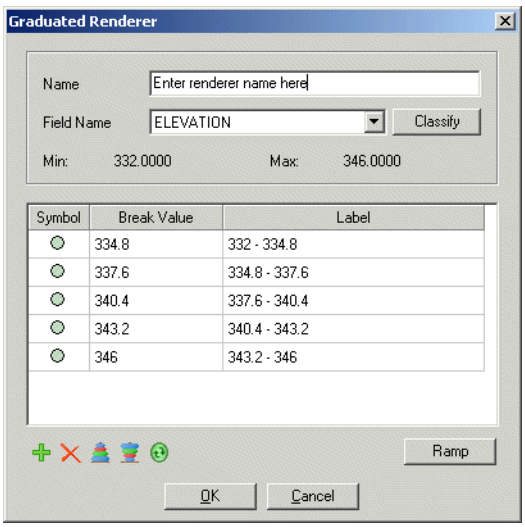
Select the desired type, and click **[OK]**.

For each Renderer type, there is a corresponding settings dialog, which is launched automatically when you create a new renderer; this can also be loaded by selecting the (Edit) button after selecting the renderer you wish to change.

Graduated Renderer

Graduated Renderer allows you to graphically display station data according to their specific interval of values. You have the option of specifying the color scheme and/or the symbol that represents the station. To use the Graduated Renderer, select **Renderer** from the **Layer** menu, click the (Add) button, and choose Graduated renderer from the available list.

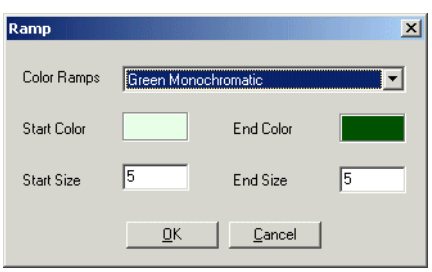
The following dialogue will allow you to compose a set of symbols for different value intervals:



Enter the **Name** for the renderer and choose the **Field** based on the values from which you want to classify your data.

[Classify] button allows you to decide how many intervals you wish to have, and HGA automatically divides the available range of values into that number of equal intervals.

Clicking on the symbol beside each interval will load the standard “Point Style” dialog allowing you to choose a specific symbol and/or color for each interval (See “Properties” on page 264). Color may also be specified as a spectrum using the **Ramp** function.



You can choose a monochromatic ramp that provides a range of the same color, but with varying degrees of darkness, a dichromatic ramp that provides a spectrum between two different colors, or a custom ramp by choosing colors for the **Start Color** and **End Color** boxes (to load the color dialogue, click on the colored box).

This dialogue also allows you to specify the size of the symbols or, if you wish, the start and end size for a range.

Click **[OK]** to return to the renderer screen. At the bottom of the Renderer dialog, there is a toolbar with additional options. These are described below:

From left to right, the function of these buttons are:

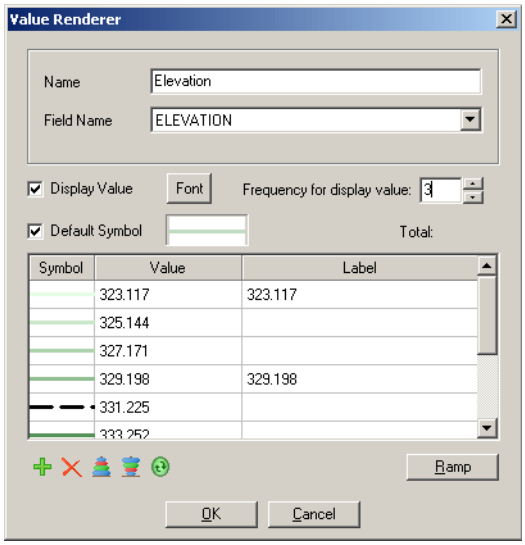
- Add a new row to the renderer table, with a new value and symbol/color
- Delete the selected row from the renderer table
- Order the values by Ascending order
- Order the values by Descending order
- Reverse the order of the colors/symbol; lowest will be flipped to highest, and highest will be flipped to the lowest.

When you are finished, click **[OK]** again to confirm the renderer settings.

Make sure the renderer you've created has a check mark in the "Visible" column and click **[OK]** to apply the renderer.

Value Renderer

The Value renderer function is very similar to the **Graduated renderer**. The Value Renderer dialog is shown below.



At the top of the dialog, specify a **Name** for the renderer and select a **Field Name** for the renderer.

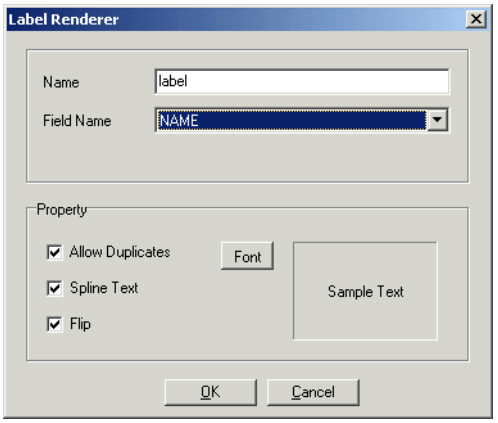
The **Value Renderer** dialog allows for detailed symbol and label rendering. Use the **Frequency for display value** vertical scroll box to set the label display frequency. You can manually specify value symbols and their corresponding labels by clicking in the desired symbol and label field. Alternatively, specify a default symbol and select the **Default Symbol** checkbox to apply the same symbol characteristics to each value.

Use the **Ramp** function to specify the color scheme and size for the symbols and click **[OK]** first to return to the **Value renderer** dialog, click **[OK]** again to accept the settings. Then also

Make sure the “Visible” box is checked, and click **[OK]** to apply the renderer.

Label Renderer

This renderer allows you to display various labels for the selected layer (stations or contour map, for example).

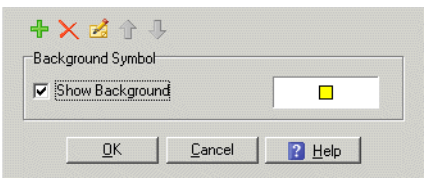


Enter the **Name** for the renderer and choose the **Field Name** which will be displayed as a label. Customize the settings as desired.

Click **[OK]** to accept the settings.

Make sure the “Visible” box is checked and click **[OK]** to apply the renderer.

You can add, delete, and edit different renderers using the toolbar located under the renderer list.



The renderer may also apply a background to the data symbols; this background can be modified using the standard “Point Style” dialog.

Create Thematic Map

This menu item allows the user to create a thematic map for any of the active Map Layers containing numeric data. A thematic map shows the spatial distribution of one or more specific data values in the form of a Pie or Bar chart. Thematic Maps can only be drawn on layers that contain data (such as stations, contour maps, etc.). They are not applicable to annotation layers.

A common example of the applications for a thematic map would be displaying the distributions of multiple chemicals.

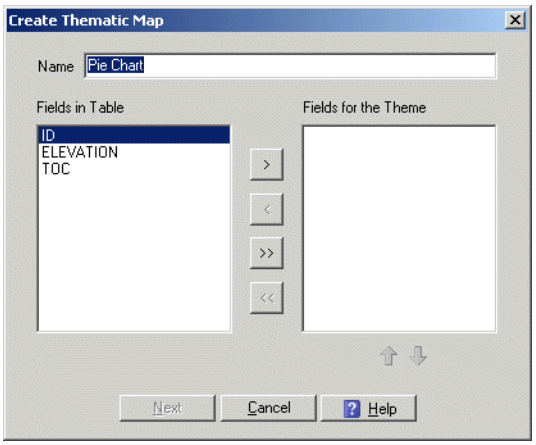
To create a Thematic Pie Chart for HG Analyst station data,

- ☞ A HydroGeo Analyst Data layer from the Layer Manager, to ensure that

this layer is active. (e.g. a Station Group or Data Query layer, such as Boreholes, Monitoring Wells, etc.)

☞ Select the menu option **Map / Create Thematic Map / Pie Chart** from the Map Manager main menu.

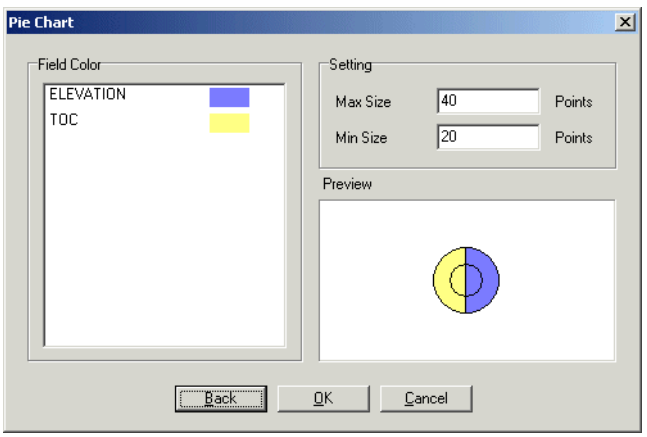
A Thematic map window will appear as shown below:



Enter a name for the map in the **Name** field. This name will appear in the thematic map list, should you choose to edit it later.

From the left panel, select the fields for map. Move fields to the right panel using the **[>]** button. To move all fields, press the **[>>]** button.

☞ **[Next]** to proceed to the next window.



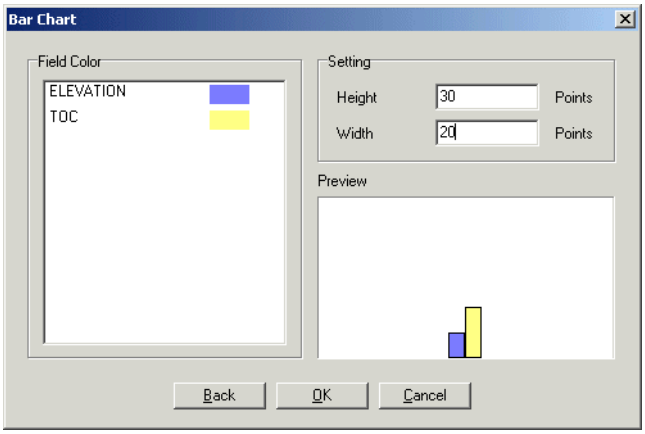
In this dialog, specify the field color by clicking on the colored rectangles to the right of

each field, and specify the chart size in the **Max size** and **Min size** fields. A preview window in the lower right corner displays a preview of the true size and color of the thematic map, as it will appear in the Map Manager.

☞ **[OK]** to create the map.

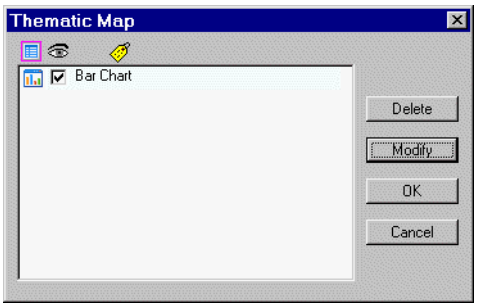
The thematic map is an entity of the selected layer; when this layer is hidden, the corresponding thematic map will also be hidden.

The **Bar Chart** is created in much the similar way. Choose **Bar Chart** from the **Layer / Create Thematic Map** menu and choose which fields you wish to map. The following dialogue will allow you to choose colors for the bars representing different fields, as well as the max height and width of the bars.



Modify Thematic Map

Provides options for modifying the properties of an existing Pie or Bar chart.

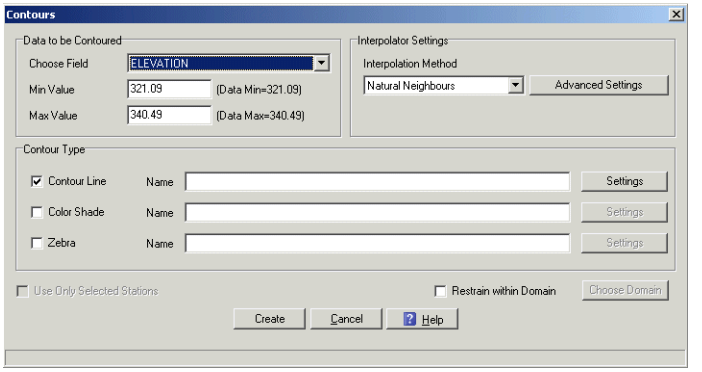


Select the map you wish to edit by clicking on the check box beside the name you entered for that map, and click **[Modify]**. The same **Bar Chart** dialogue will appear allowing you to go through the procedure again and change various aspects of the chart

.

Create Contours

Provides options for creating contours with data from a selected field, from the selected points layer. Upon selecting this menu item, the following dialog will appear:



The gridded data can be represented as the following **Contour Types**:

- Contour lines
- Color shaded map
- Color zebra (zonations)

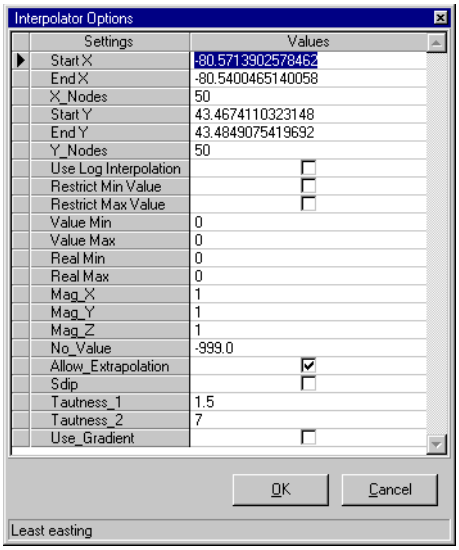
Select the desired Contour type, and enter a name for the layer. For each type, there are additional settings that can be accessed by clicking on the **[Settings]** button. See the sections below for more details on these settings.

Data to be contoured

- Select a **Field** that contains the data you want to contour.
- Define the **Min** and **Max** values, or accept the defaults

Interpolation Settings

- Under **Interpolator Settings,** select the interpolation method (choose from Natural Neighbor, Inverse Distance, or Kriging).
  To use the advanced interpolation settings, click the **[Advanced Settings]** button, and advanced options will be displayed as shown below (for Natural Neighbor):



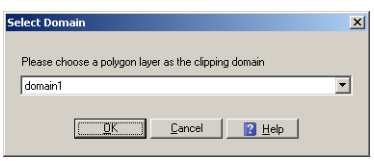
You may modify the interpolation settings, then click **[OK]** to return to the main window. For more details, see **“Appendix D: Advanced Interpolation Settings” on page 529**.

Use Only Selected Stations

When selected, the contour component will use only those stations that are selected on the layer, as the data source for the contouring. The option is only enabled when one or more stations are selected. If not selected, all stations on the layer will be used.

Restrict Within Domain

This option allows you to clip contours lines to a selected polygon layer.



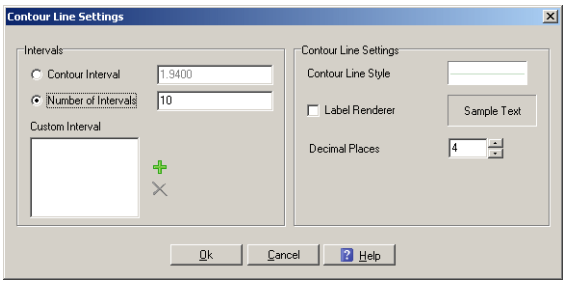
You may select any polygon shapefile from the combo box. Then click **[OK]** to continue. The calculated contours will then be clipped at the edges of the polygon.

NOTE: If the polygon is greater in extents than the selected station layer, the contouring will end at the furthest point. Currently, extrapolation to the edge of the polygon is not possible.

When you are satisfied with the settings, click the **[Create]** button to create the contour map.

Contour Line Settings

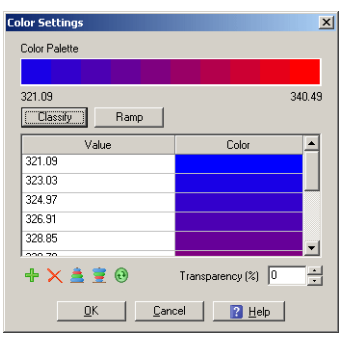
Click on the **[Settings]** button beside Contour Lines, and the following dialog will appear:



- Specify **Intervals**; you may select to define the **Contour Interval** (e.g. 0.5, 1.0, 5, etc.) or the **Number of Intervals** (5, 10, 20, 50, etc.). You may also define **Custom Contour Lines** in the grid in the lower corner. Use the + and X buttons to add/remove contours respectively.
- Under **Contour Line Settings,** specify the line color, thickness, style, and label settings. **Label Renderer** will add a label to the lines.

Color Shading / Zebra Map Settings

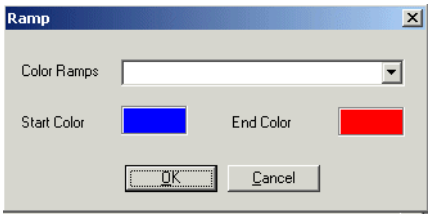
Click on the **[Settings]** button beside Color Shading or Zebra, and the following dialog will appear



The **Color Settings** Renderer allows you to define different colored zones/ranges according to their specific interval of values.

- The **[Classify]** button allows you to decide how many intervals you wish to have, and HGA automatically divides the available range of values into that number of equal intervals.

- The **[Ramp]** option loads the following dialog.



You can choose a monochromatic ramp that provides a range of the same color, but with varying degrees of darkness, a dichromatic ramp that provides a spectrum between two different colors, or a custom ramp by choosing colors for the **Start Color** and **End Color** boxes (to load the color dialogue, click on the colored box).

Click **[OK]** to return to the renderer screen.

Alternatively, you may set the color for each value; simply click on the Color box under the Color column, and the Windows Color palette will display. Select the desired color, and click **[OK]** to continue. Repeat this for other values, as desired.

Adjust the **Transparency** option to make it possible to see layers under the color shading/zones. The higher the value, the more transparent the layer will be. The value must be within the range 0-100.

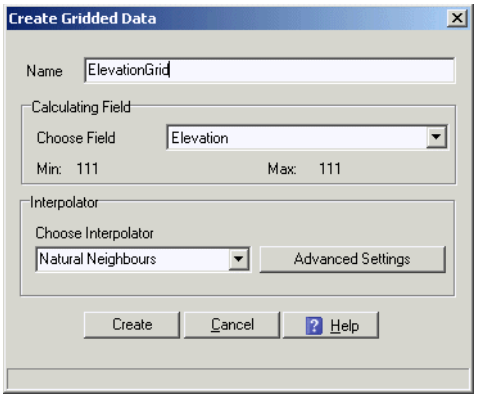
The remaining options are similar to those for Graduated Renderers (Add Value, Delete Value, Ascend, Descent, Change Color); see “Graduated Renderer” on page 280 for more details.

When you are finished, click **[OK]** to return to the Contours screen.

Create Gridded Data

This feature allows you to interpolate data for the current layer, and create a grid file (.GRD) for use in HGA 3D Explorer or other applications. For example, if you have a station layer selected, you can create a grid file based on station elevations or TOC (top of casing) elevations.

Select this menu item and the following dialog will appear:



Enter a name for the grid file, and select a field containing the source data. Click the **[Create]** button to create the file. The grid file will be created in the HGA project's folder, in the "Surface" sub-folder:

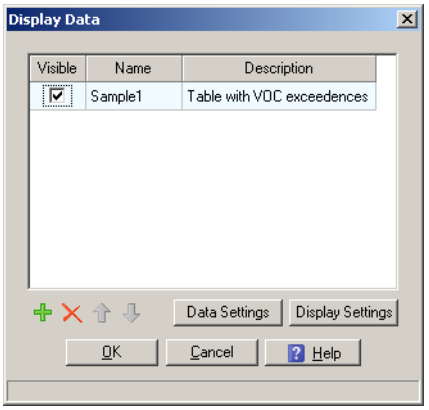
(for example, "D:\Program Files\HGAnalyst\Projects\Demo_Project\Surface\test.grd")

NOTE: As with contours, you can select an interpolation method, and customize interpolation settings by clicking on the **[Advanced Settings]** button.

Display Data

This feature allows you to display data in a plot or tabular format on the map, for the current points map layer. Fields are based on points data loaded from Station Groups or Data Queries (created using the Query Builder). You may define conditions for fields, and highlight rows in the tables that violate the conditions. For plots, the templates are selected from available Chart templates.

To activate this feature, first select a layer that contains points data (i.e. a data query or a station group) from the Layer Control. When you select the **Display Data** option from the **Layer** menu, the following dialog will appear:



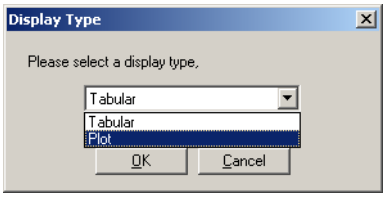
This dialog allows you to manage the various layouts for the map layer.

In the first column, show/hide the layout by setting the **Visible** status.

Define the **Name** in the second column.

In the third, you may optionally enter a **Description**.

Click on the (Add) button to add a new layout. In the combo box that appears, select either Tabular or Plot (shown below).



Click on the (Delete) button to delete the selected layout.

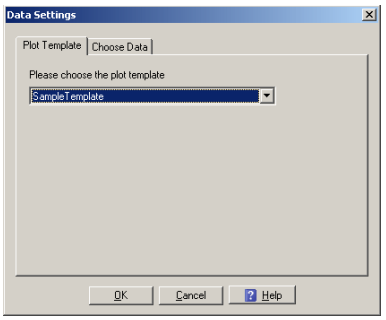
Use the button to move the selected layout up.

Use the button to move the selected layout down.

Next you must define the settings for the layout.

Plots

For a Plot display, click on the **[Data Settings]** button and the following dialog will appear:



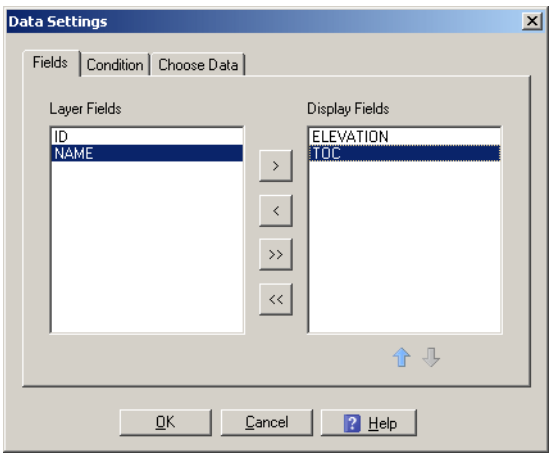
In the list, choose from available plot templates that were created using the chart component. For details on how to create plot templates, please see Chapter 14: Saving Plot as Template. In order to display the plot in the map, the following requirements in the template must be met:

- Plot Grouping and Series Grouping must be done by station ID
- The plot template must contain data for the selected stations

The remaining settings for the plot are similar to those described in the sections "Choose Data" tab below.

Tabular

For a tabular display, click on the **[Data Settings]** button and the following dialog will appear:

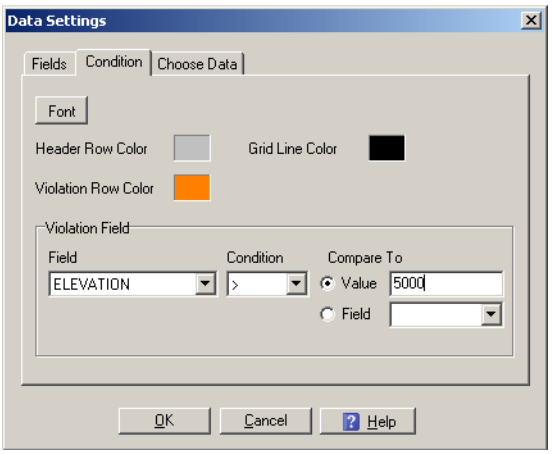


In the **Data Settings** dialog, you select which **Layer Fields** from the layer should appear as **Display Fields** in the layout table, as well as define the **Display** settings.

Select the desired fields from the left panel under **Layer Fields**, then move fields to the **Display Fields** under the right panel using the **[>]** button. To move all fields, press the

[>>] button. To remove fields from the **Display Fields**, click on the **[<]** or **[<<]** buttons respectively. Use the button to move the selected field up. Use the button to move the selected field down.

Click on the **Condition** tab, and you will see options for defining validation rules for one of the selected fields, along with display settings for the table.



The **Header Row Color** controls the color of the first row in the layout table.

The **Violation Row Color** allows you to assign a color to values in the table that exceed the violation conditions (explained below). This is useful for quickly identifying exceedences on the map.

The **Grid Line Color** controls the color of the gridlines in the table.

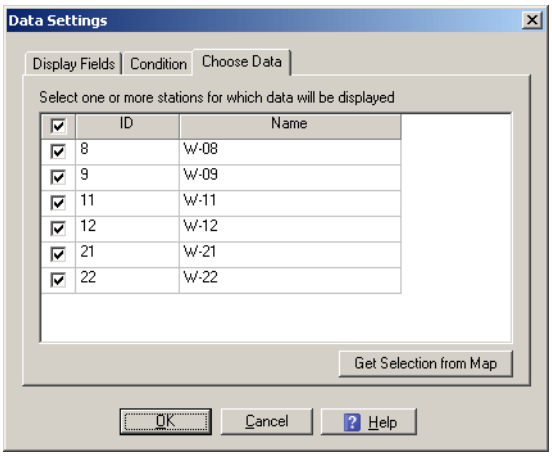
Under the **Violation Field** frame, you may specify a condition for one of the display fields. Select a **Field** from the combo box, then a **Condition** (<, >, =, etc.), and define the **Compare To** settings. There are two options available:

- Compare to a **Value**: simply type the value in the provided text box, OR
- Compare to a **Field**: select another field from the data query, to compare against.

The possibilities are limitless, but here are some examples:

- concentration > 5000 ug/l (a government guideline, or MCL) as shown in the screenshot above
- depth to bedrock > 40 feet
- overburden thickness < 50 feet
- concentration of a chemical exceeds the criteria limit, where the criteria limit is available in another field in the selected data query

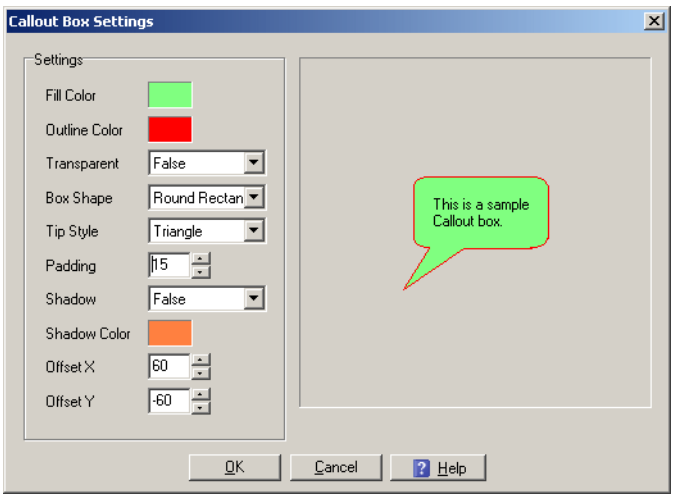
In the **Choose Data** tab, you can specify which stations should display the data table. This is useful if you have a station group with numerous stations, and are interested in displaying the data summary table only for a few stations.



Simply place a check-box beside the stations that should display the data summary table.

If you click on the **Get Selection Map** button, then the Map Manager will "get" only those stations that are selected on the map layer on the map project, and use only those for the Display Data. This button is enabled only if you have at least one station selected in the map layer.

Once you are finished, click **[OK]** to return to the layout window. From the **Layout Setting** dialog, click on the **[Display Settings]** button in the **Callout Box** column, and the following dialog will appear:

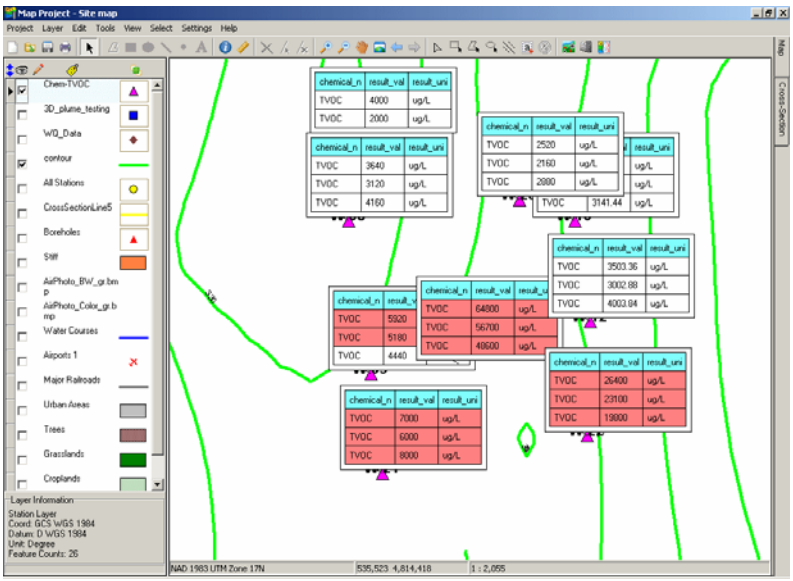


In the **Callout Box Settings** dialog, you can modify several display properties for the callout box. The callout box is the box, oval, or bubble, that contains the data for the selected station. A preview is shown on the right side of the window, in the image above. The following display settings are available:

- **Fill Color**: set the fill color for the callout box
- **Outline Color**: set the color for the outline of the callout box
- **Transparent**: set the transparency; select from True or False
- **Box shape**: select the box shape; choose from Rectangle, Round Rectangle, or Oval
- **Tip style**: set the tip style; choose from Triangle or Line
- **Padding**: set the padding thickness. The higher the padding value, the larger the box shape will be around the tabular values in the layout
- **Shadow**: display a shadow around the callout box; select from True or False
- **Shadow Color**: select the shadow color; only used if Shadow has been set to True
- **Offset X**: set the X Offset; this parameter controls how far the callout box will be placed horizontally from selected station.
    - A positive offset will result in the callout box displayed to the right of the station
    - A value of 0 will center the call out box over the station
    - A negative offset will result in the callout box displayed to the left of the station
- **Offset Y**: set the Y Offset; this parameter controls how far the callout box will be placed vertically from selected station.
    - A positive offset will result in the callout box displayed below the station
    - A value of 0 will center the call out box over the station
    - A negative offset will result in the callout box displayed above the station

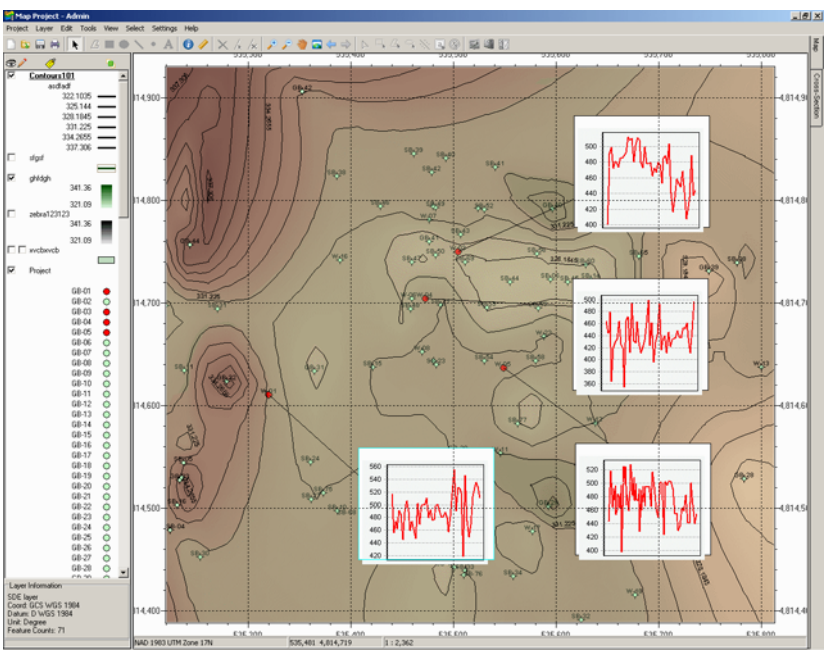
When you are finished with the Display Settings, click **[OK]** to return to the layout window. Click **[OK]** once more to create the layout on the map, as seen in the examples below.

Example of Display Data: Chart



You can see that sample values that exceed the specified conditions (TVOC concentration result value greater than 5000 ug/l), are shaded red for easy detection.

Example of Display Data: Plot



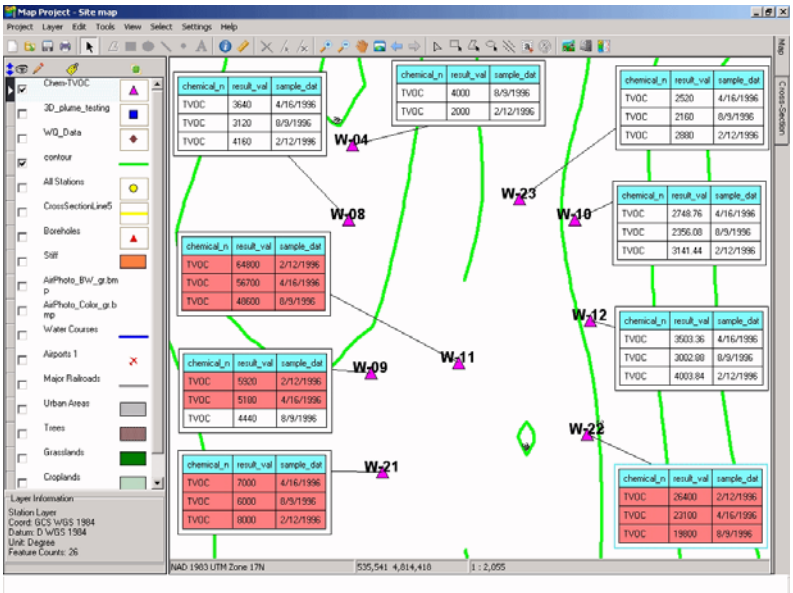
When stations are clustered, it may be necessary to modify the display location of the callout boxes. You have the option to manually move individual callout boxes to a new location to improve presentation. This is explained below.

Edit Layout Setting

To edit the position of the callout box:

- *Right*-mouse click on the map window, and select **Edit Layout** from the pop-up menu
- Click once on any callout box to select it; the box will become highlighted in a color outline, indicating it has been selected
- Left click on the callout box, and using your mouse, drag the box to the new location

When you have done this, the result could be similar to the example shown below.



When you are finished with the position edits, you must *right*-mouse click on the map window and turn off the **Edit Layout** option, to disable this feature.

To edit the remaining layout settings, including fields, violation conditions, and display properties, simply select **Layer / Display Data** from the main menu, then modify the settings as explained above.

8.2.3 Edit

The Edit menu contains standard windows functions such as Cut, Copy, and Paste objects, as well as other options for editing shapefiles.

NOTE: Before editing a layer make sure that the **Editable** check box is selected. After editing, deselect the **Editable** check box on the Layer Manager.

Cut

Cuts the selected object to clipboard; only available if an object (polygon, rectangle, circle, line, or text) is selected.

Copy

Copies the selected object; only available if an object (polygon, rectangle, circle, line, or text) is selected.

Paste

Pastes the clipboard item onto the current layer.

Delete

Deletes the selected object.

Delete All

Deletes all objects from the current map layer.

Add Vertex

Provides an option to add a vertex to the selected object. To add a vertex:

- Activate the desired map layer containing an annotation object and make it editable
- Select an object on this layer
- Click on the (Add Vertex) button or select the **Add Vertex** option from the **Edit** menu/
- Place the mouse cursor at the desired location; the mouse cursor will change to a pen
- Click once with the left mouse button at this location to add a vertex

This menu item is only available when an object (polygon, circle, line or rectangle) is selected.

Delete Vertex

Provides an option to delete a vertex from the selected object. To delete a vertex:

- Activate the desired map layer containing an annotation object, and make it editable
- Select an object on this layer; all its vertices will be highlighted

- Click on the (Delete vertex) button or select the **Delete Vertex** option from the **Edit** menu
- Place the mouse cursor on the vertex to be removed; the mouse cursor will change to an “X”
- Click once with the left mouse button on this vertex to remove it from the object

This menu item is only available when an object (polygon, circle, line or rectangle) is selected.

Copy Map to Clipboard

Copies the entire Map Window to the clipboard. The map window can then be pasted as an image in other applications.

8.2.4 Tools

The Map Manager provides annotation tools which allow for drawing shapes and inserting text labels on the map. The drawing tools are available in both the **Tools** menu and in the Map Manager toolbar.

The options for the annotation tools allow modifying the color and style of the annotation objects.

The annotation items are only available on map layers with the corresponding object type (i.e. text, line, point, polygon). These are called annotation layers. For example, to draw polygons on the map, a new map layer with the type “Polygon” must first be created (using the **Layer / New** menu option), or if a polygon layer already exists it has to be set to “edit” mode. To add text to a map layer, a new layer with the type “Text” must first be created (using the **Layer / New** menu option).

The following annotation options are available:

Polygon

Provides the option to draw a polygon. This option is available only when a polygon shapefile layer is selected and set for editing.

Rectangle

Provides the option to draw a rectangle. This option is only available if a polygon shapefile layer is selected and set for editing.

Circle

Provides the option to draw a circle. This option is only available if a polygon shapefile layer is selected and set for editing.

Line

Provides the option to draw a line. This option is only available if a line shapefile layer is selected and set for editing.

Point

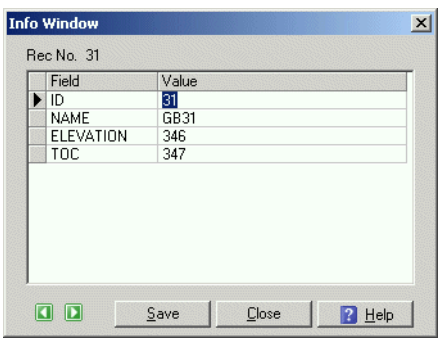
Provides the option to add points to the map layer. This option is only available if a point shapefile layer is selected and set for editing.

Text

Provides the option to add text labels to a map layer. This option is only available if a text layer is selected and set for editing.

Information

Provides a dialog containing information about the selected station, or other objects such as contour lines; an example is shown below.



To load the Information dialog,

- Select a layer containing HG Analyst station data.
- Select **Information** from the **Tools** menu, or click on the (Information) button in the toolbar
- Click once on any station within the selected layer.

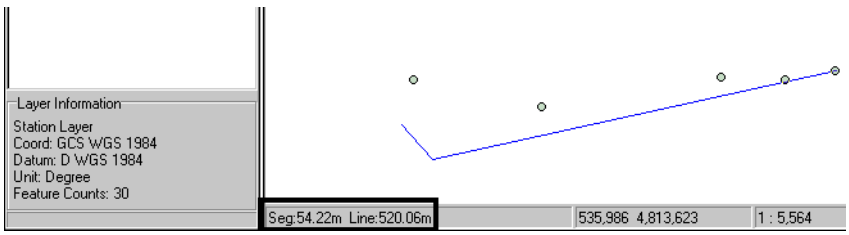
This window will display Station ID, Name, Elevation, TOC, and any other fields depending on the layer type. If there are stations that share the same ID, and are hidden behind the selected station, then the scroll arrow buttons (in the lower-left corner) can be used to view the information for other stations.

NOTE: The information tool can only be used on shape layers that are visible and active.

Measure

Provides an option to measure distances on the map window. To use this utility:

- Select **Measure** from the **Tools** menu, or click on the (Measure) button in toolbar.
- Place the mouse cursor at the start point for the line. The mouse cursor will change to a cross-hair.
- Click once with the left mouse button to start the line
- Drag the mouse cursor to the end point of the line
- To add a vertex to the line, click once with the left mouse button, then continue drawing to the new location.
- As the line is drawn, the distance from the start point to the end point (i.e. the current mouse cursor location) is displayed in a status bar at the bottom of the Map Manager window. This is indicated in the sample image below:



- There will be two values displayed here; The **Seg** value is the distance from the current cross hair to the previous vertex location (i.e. the distance of the line segment). The **Line** value is the total line distance from the start point, including all segments.
- To finish the line and end the line measurement, double-click the left mouse button.

Define Cross-Section Line

Allows you to create a cross section line. Make sure you are in one of the HGA data layers before drawing a cross section line.

Please see the section “Defining a Cross Section Line” on page 313 for more details.

Create Cross-Section

Loads the cross section editor, for the selected cross section line. This menu item is activated only when a cross-section line is selected/highlighted. There are two ways to highlight a cross-section line:

- Choose the cross-section line on the cross section line layer
- Draw a new cross section line on a station layer.

For more details on creating cross sections, please see Chapter 9: Cross Section Editor.

8.2.5 View

This menu provides options to modify the appearance and size of the Map Window, and the layers within the map project.

Full Extent

This menu item will zoom the map window to its original full extents.

Zoom In

Provides options for zooming into a section of the map that is defined by drawing a rectangle. Place the cursor on the map and click once to define one corner of the rectangle, drag to a second position to define the opposite corner of the rectangle, and release the mouse button. The selected section will be adjusted to fill the screen.

Zoom Out

Provides options for zooming out on the map. Click this menu item and the map window will zoom out. The current screen will be zoomed out by a factor of two unless it is already in full-extent mode.

Zoom to Active Layer

Zooms the map window dimensions to the extent of the selected map layer.

Previous Extent

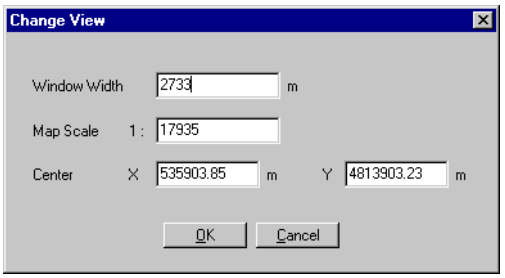
Zooms the map window to the previous window dimensions.

Next Extent

Zooms the map window to the next window dimensions. Activated only after **Previous Extent** has been used.

Custom Extent

Allows you to manually set the zoom extents and the center of the Map Window. When this menu item is selected, the following dialog will appear.



Provide, the desired viewable width, map scale, and X, Y coordinates of the map that will be repositioned at the center of the map window.

As the Zoom (window width) changes, the Map Scale changes and vice versa.

The Zoom window width has equal proportions left and right of center.

TIP: When you save the map project, the view extent is saved together with the map project. The next time the map project is opened, the view extent will be restored.

Turn on All Layers

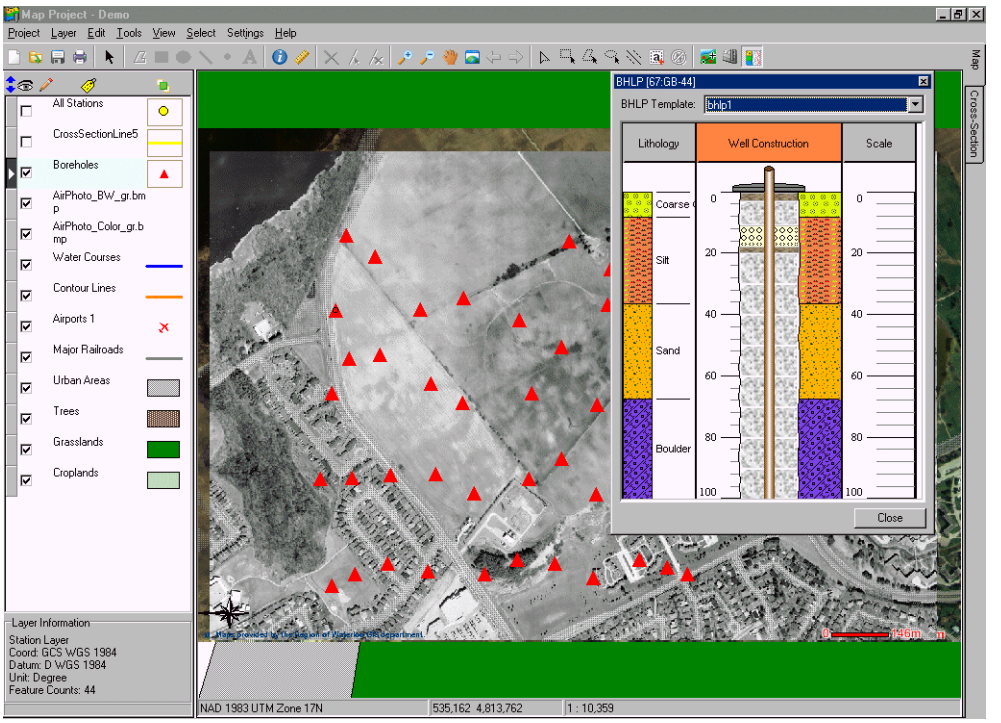
Makes all layers visible.

Turn off All Layers

Hides all layers.

View BHLP

Allows the you to view the borehole log plot (BHLP) for any station. To view a BHLP make sure that you are in the HGA data layer, select this option, and click on any station. An example taken from the Demo project, is provided below:



From the top of the BHLP viewer, select the template from the combo box. These templates are defined in the main HG Analyst window, under the **Borehole Logs** node.

For more information, see Chapter 12: Borehole Log Plotter.

8.2.6 Select

This menu provides options for selecting or de-selecting stations on the selected layer in the Map project. Typically, this involves stations from the HydroGeo Analyst project. Once the station's data points are selected, a red circle will appear on top of the station's symbol.

Stations may be selected on the map by:

- Clicking individually
- Drawing a polygon, box, or circle (all stations inside the object become selected)
- Drawing a line and defining a buffer distance (all stations within the buffer distance become selected)

Multiple station selections may be accomplished with the use of the <Ctrl> key. Simply press and hold down the Ctrl key after making the initial selection, then use one of the tools to select or de-select additional stations.

Each selection option is described below.

Pointer

Allows to select stations one by one. When a station is selected, a red circle will appear on top of the station's symbol. When another station is selected, the previously selected station is un-selected and the new station's symbol becomes selected, indicated by a red circle on top of the station's symbol.

Rectangle

Allows to select stations within a drawn box. To draw a rectangle, place the cursor in the map window, click once with the left mouse button in the area of interest and drag a window around the area, then release the mouse button. All stations within the box will become selected, indicated by a red circle on top of the station's symbol.

Polygon

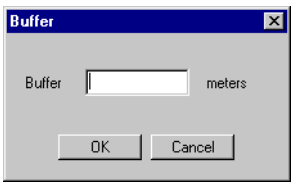
Allows to select stations within a drawn polygon. Place the cursor in the map window at one point of interest, click once with the left mouse button and digitize a polygon around the area of interest. To add a vertex to the polygon, continue to click with the left mouse button. To close the polygon, double click the left mouse button at the final vertex. All stations within the polygon will become selected, indicated by a red circle on top of the station's symbol.

Circle

Allows to select stations within a drawn circle. To draw a circle, place the cursor in the center of the area of interest, click with the left mouse button and drag an expanding circle around the area, then release the mouse button. All stations within the circle will become selected, indicated by a red circle on top of the station's symbol.

Line

Allows to select stations near a drawn line. To draw a line, place the cursor at one end of the area of interest, click with the left mouse button, and digitize a line through the area of interest. To add a vertex to the line, click with the left mouse at the vertex location. To finish the line, double click the left mouse button at the final vertex location. This will open the buffer distance window.



Enter a buffer distance from the drawn line, and click **[OK]**. All stations within the buffer distance of the line will become selected, as indicated by a red circle on top of the station's symbol. The Buffer distance extends out, perpendicular to the line location.

All

All stations on the current Map Layer will be selected.

None

All stations that are selected on the current Map Layer will be deselected.

NOTE: Once selected, you cannot deselect individual stations.

Add to Station Group

Provides an option to add the selected stations to a HydroGeo Analyst station group. Using one of the Selection tools mentioned above, select one or more stations, then choose this menu item from the **Select** menu, and the following dialog will appear.

Stations can only be added to an existing station group.

Delete from Station Group

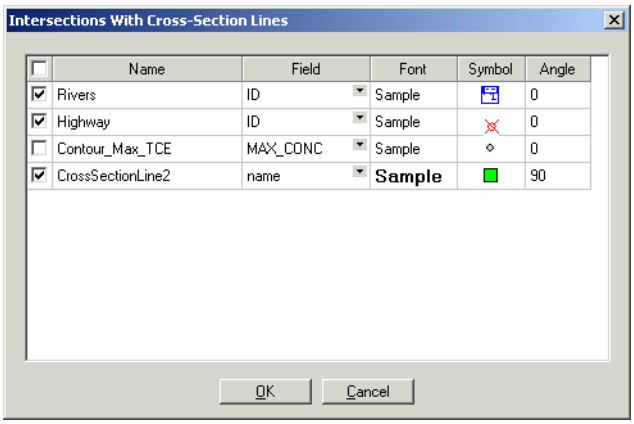
Remove the selected stations from a HydroGeo Analyst station group. The stations will be removed from the station group map layer currently selected and active in the layer

manager.

8.2.7 Settings

Cross Section

This dialog allows modifying the display properties of features that intersect with cross section lines, when viewing a cross section in the Cross Section Editor. Selecting this option launches a dialog similar to that shown in the following figure. The dialog makes a list of all line type layers available for selection.

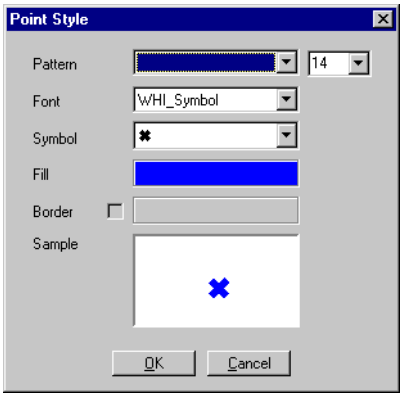


A cross section line may intersect with one or more cross sections, or any line type features such as rivers and highways; in this dialog it is possible to specify the features to be displayed on the cross-section plots. The dialog also allows you to set display properties of these features. The following options are available:

- **Name**: Name of the intersecting layer (read-only)
- **Field**: Select a field to represent the layer (typically Name, ID, Text)
- **Font**: Select a font for the label
- **Symbol**: Define symbol properties for the selected layer
- **Angle:** Define label angle

The **Field** column contains a list of available fields for the selected layer. This field will be used as the label in the cross section view.

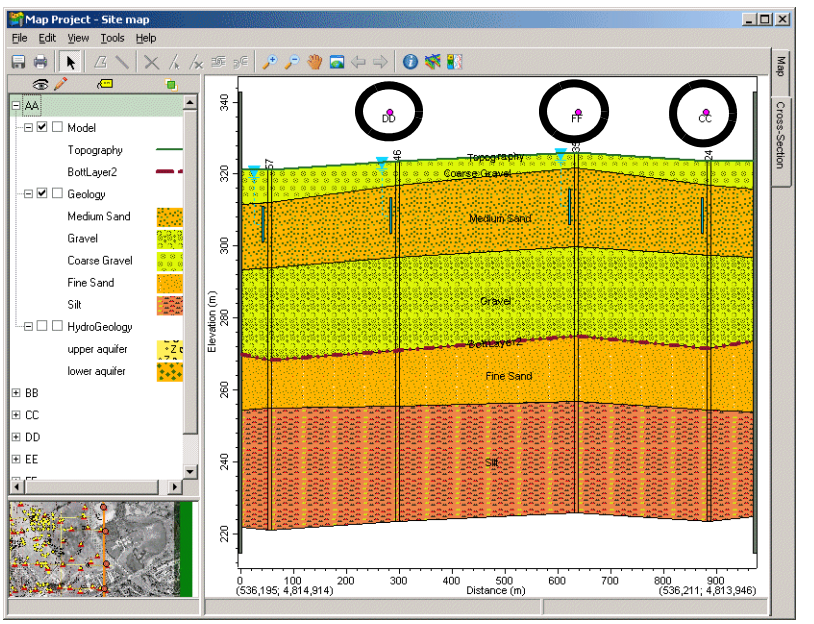
The **Symbol** column contains the symbol options for the selected layer. Double click on the field in this column to load the options shown below.



To show the intersections on the Cross-Section,

- Click on the **Cross-Section** tab.
- From the top Menu Bar click **Tools**, and then **Update Cross Section**.

The following image shows the intersections between the cross-sections:

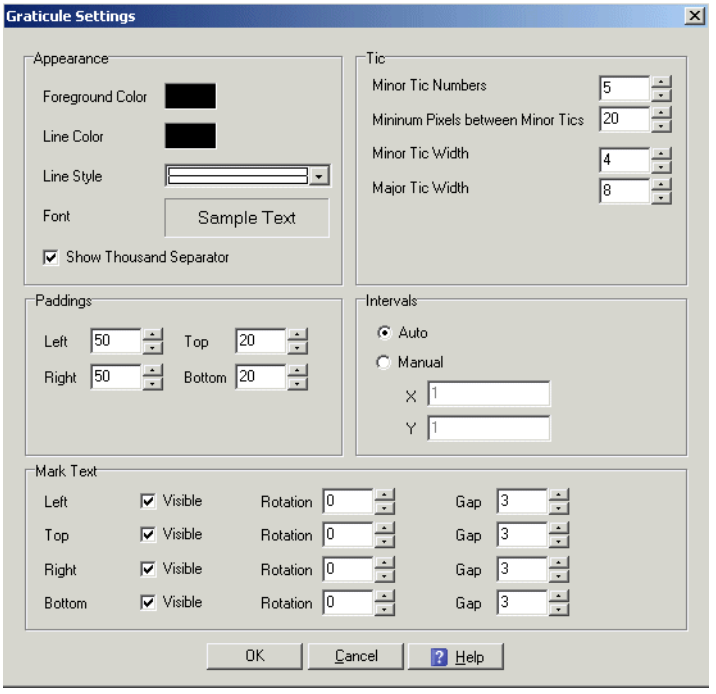


NOTE: In order to see intersecting cross-sections in the cross-section editor, the corresponding Map Manager project must be open.

For more details on managing intersecting layers in the cross-section editor, please see “Intersecting Layers” on page 334.

Graticule

Provides settings for the graticule (also referred to as gridlines) on the map. The following dialog will appear:



Appearance

In the appearance frame, you can edit the line color, style, font.

Tic

Allows defining the number of minor and major tics.

Paddings

Controls the amount of buffer space between the edge of Map Manager window display, and the labels on the axis. It may be necessary to increase this value when the X and Y co-ordinates contain many digits

Intervals

Controls the space between the major graticule lines. You can accept the system calculated Auto values, or enter Manual values.

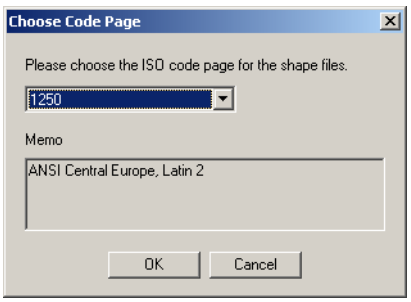
Mark Text

Controls the axis labels. For each axis, you can set the visible status, rotate the label,

and control the gap between the label and the axis itself.

Code Page

Use these settings to convert accented characters into a shapefile format that can be recognized by the Map Manager. The following options are available:



From the combo-box, select the **Code Page** that should be used for the shapefiles in your map project. The Map Manager provides several ISO standards. For a complete list of which standard you should select (based on your language and regional settings) please see “Appendix E: Map Manager: ISO Codes” on page 535.

NOTE: This option is available for new shapes files only; existing shapefiles cannot be converted.

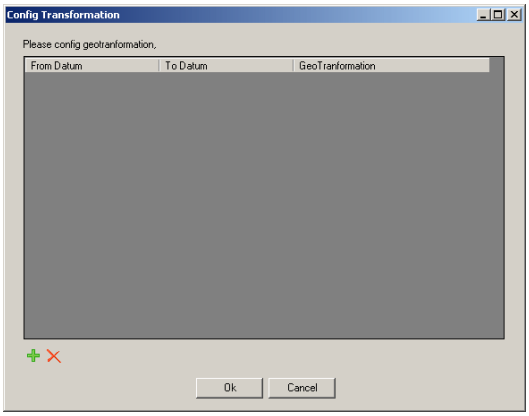
Click **[OK]** when you are finished.

Config Geotransformations

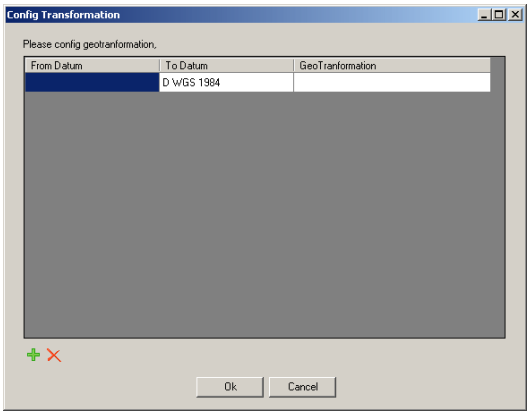
This menu item allows you to configure the geotransformation settings for a Map Project. These settings must be defined so that Map Manager can properly convert shapefile coordinates derived in one geographic coordinate system to values expressed in another. Once these settings have been defined, Map Manager will make the required transformation on-the-fly, when a shapefile is opened.

For example, if your current map project is set to North American Datum 1983 (NAD 83), and you wish to import a shapefile that was derived using the North American Datum 1927 (NAD 27) projection, you must first configure an appropriate geotransformation. To configure a geotransformation, follow the steps below:

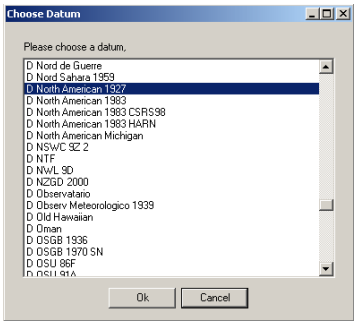
Upon selecting, the following dialog will open:



Click the **Add** button to add a geotransformation record.



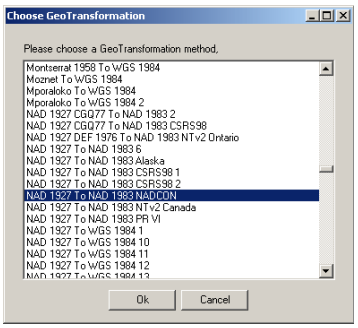
Click the empty cell located under the **From Datum** header. The following dialog will appear:



In the Choose Datum dialog, select the input datum from the list of projection systems. Click **[Ok]**

Next, click the cell located under the **To Datum** header. Again, the Choose Datum dialog will open, and you can select the output datum for the geotransformation. Click **[Ok]**.

Finally, click the cell located under the **Geotransformation** header. The following dialog will open.


Choose GeoTransformation
Please choose a GeoTransformation method.
Montserrat 1958 To WGS 1984
Moznet To WGS 1984
Mporaloko To WGS 1984
Mporaloko To WGS 1984 2
NAD 1927 CGQ77 To NAD 1983 2
NAD 1927 CGQ77 To NAD 1983 CSRS98
NAD 1927 DEF 1976 To NAD 1983 NTv2 Ontario
NAD 1927 To NAD 1983 6
NAD 1927 To NAD 1983 Alaska
NAD 1927 To NAD 1983 CSRS98 1
NAD 1927 To NAD 1983 CSRS98 2
NAD 1927 To NAD 1983 NADCON
NAD 1927 To NAD 1983 NTv2 Canada
NAD 1927 To NAD 1983 PR VI
NAD 1927 To WGS 1984 1
NAD 1927 To WGS 1984 10
NAD 1927 To WGS 1984 11
NAD 1927 To WGS 1984 12
Ok
Cancel

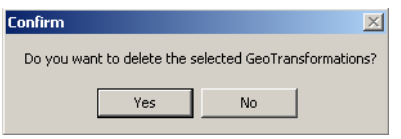
Here you can select the appropriate transformation method. Once selected, click **[Ok].**

Once you have configured the geotransformation, click the **[Ok]** button to exit. From this point on, whenever you open a shapefile, Map Manager will refer to these settings and make the appropriate transformation, if required.

You can define multiple transformations by repeating the steps above. Please note that if multiple records exist for the same transformation type (e.g from NAD 27 to NAD 83), but each is assigned a different method, Map Manager will only use the first transformation listed, for that particular transformation type.

To delete a defined geotransformation, select a record and click the **Delete** button.

Click [**Yes]** to confirm.



8.2.8 Help

Contents

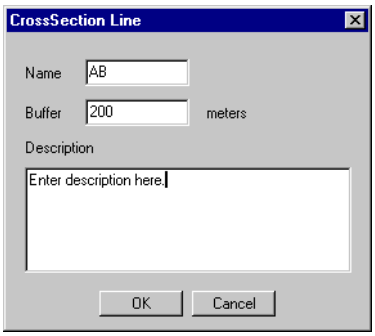
Contains the contents of the Map Manager help.

8.3 Defining a Cross Section Line

Use the Map Manager to define the locations of cross section lines, which can then be interpreted in the Cross Section editor. There are two methods for defining cross section lines: **Digitizing** and **Use Existing Polyline**. Each method is described below.

Digitizing a Cross Section Line

- In the Map Manager, open an existing map project or create a new map project
- Select a HydroGeo Analyst data layer (i.e. station data), and ensure this is visible and active (selected). If you do not have such a layer, you may create one based on station groups that are available in your HydroGeo Analyst project. To do this use the **Layer > Load HGA Data** option to select a station group. The Map Manager creates a layer with stations that are available in the group.
- Zoom-in to the area of interest (optional).
- Click the (Cross-Section Line) button at the right end of the toolbar, or select **Tools/Define Cross-Section Line** from the Main Menu.
- Place the mouse cursor at the starting point of the line, and click once with the left mouse button.
- Click again at another location to add a vertex to the line. You may add one or more vertices that define the cross-section line. **Note**: If you wish to place a vertex beyond the extent of the current map view, click and hold the right mouse button to **pan** across the map. Also, you can use the mouse wheel to **zoom in** and **zoom out**, while defining the cross section line. \
- At the end point of the line, double-click the left mouse button to finish. This will launch the dialog shown below:



- For each cross section line, specify a **Name, Buffer Distance** and **Description**. The **Buffer Distance** determines which stations will be included in the cross section; stations which lie within the buffer distance will all be selected (as indicated by a red circle on top of the station's symbol) and included in the cross-section. The Buffer Distance is projected out perpendicular to the cross-section line.
- Click **[OK]** to accept the Line attributes.
- If necessary, selected stations can be deselected by clicking on each of them while holding down the <Ctrl> key.
- If necessary, extra stations may be added to the selection by clicking on one or more stations while holding down <Ctrl> key.

NOTE: Once a cross-section line has been created, stations can still be added to or removed from the line by selecting the line, then right-clicking and choosing the **Add/ Remove Stations** option. Stations can then be added/removed by clicking on the desired stations. In order to use this feature, the station layers on which the cross-section are based (e.g. Boreholes), must be set to Visible in the Layer Control.

The cross-section can then be created as follows.

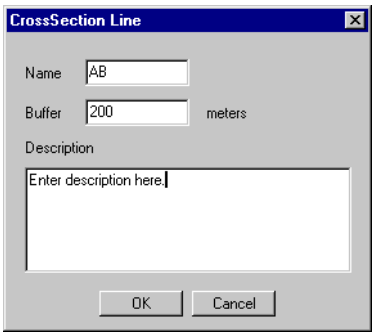
- Select **Tools > Create Cross Section** from the Main Menu, or click on the Cross-Section button on the toolbar.

Click **[Yes]** to create the cross-section; the name assigned to the cross-section line will be used for the cross section name.

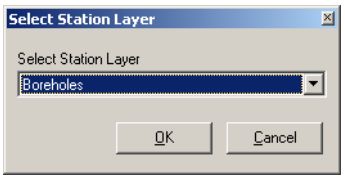
Use Existing Polyline

You can create a cross section line from an existing polyline layer. To do so, follow the steps below:

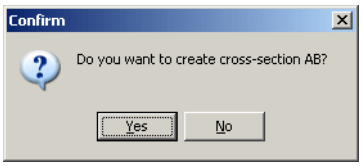
- Right-click the desired line segment and select **Convert to Cross Section Line** from the pop-up menu.



- Specify a **Name, Buffer Distance** and **Description**. The **Buffer Distance** determines which stations will be included in the cross section; stations which lie within the buffer distance will all be selected (as indicated by a red circle on top of the station's symbol) and included in the cross-section. The Buffer Distance is projected out perpendicular to the cross-section line.
- Click **[Ok]** to accept the line settings. The **Select Station Laye**r dialog will display.
- Select the appropriate station layer from the dropdown list box and click **[Ok**].



- The following message will display:



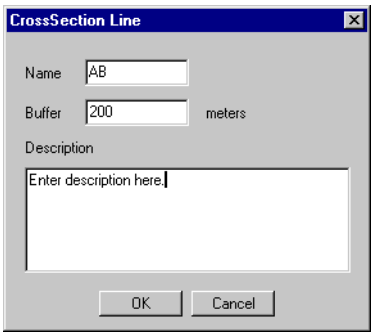
- Click **[Yes]** to open the cross section in the Cross Section editor.

This will load the cross section editor. For more details on creating cross-sections, you may refer to Chapter 9: Cross Section Editor.

Modify Buffer Distance

To modify the buffer distance of a cross-section line:

- Select the cross section layer from the Layer Manager panel.
- Select a cross-section line.
- Right-click, and select **Update Buffer** from the pop-up menu.



- From the **CrossSection Line** dialog, specify a new buffer distance.
- Click **[Ok]**.

Map Manager will now regenerate the cross-section line using the new buffer distance.

Note: Buffer distances for cross sections generated in past versions of HGA cannot be modified.

9

Cross Section Editor

The Cross-Section Editor is designed with easy-to-use tools for interpreting geological and hydrogeological data, as well as interpreting data for groundwater flow models. Generating model layers for use as modeling layer elevations in groundwater modeling packages such as Visual MODFLOW Pro has never been easier!

In addition, the Cross-Section Editor is seamlessly integrated with the HydroGeo Analyst 3D-Explorer, a tool that combines and displays one or more cross-sections in a 3D fence diagram view!

The Cross-Section Editor allows for three types of data interpretations:

- Geologic (containing lithology structure data)
- Hydrogeologic (containing locations of aquifers, aquitards, etc.)
- Model (containing locations of model layer lines, which may be used in numerical groundwater modeling)

The Cross-Section Editor provides users with the following key features:

- Digitize geologic and hydrogeologic layers using the polygon draw tool
- Select standard cross-section fill patterns from the Geology
- Copy zones from geology layers in order to define hydrogeology zones
- Display the locations of intersecting layers and other cross sections (using symbols and labels)
- Display water table location in cross section view
- Dynamically view the spatial orientation of the boreholes in the Map Preview Window - simply move the mouse over the 2D borehole to highlight its location on the map
- View the orientation of cross-sections as they relate to the Map Preview Window
- Define properties of intersecting features (other layers or cross sections)
- Display screened interval in cross section view
- Modify labels for lines and polygons
- Zoom in/out and pan features
- Launch cross-section for viewing in the HydroGeo Analyst 3D Explorer
- Export cross-section view to image format
- Export model layer points for use in groundwater models, including Visual

MODFLOW
- Send cross-sections to the Report Editor to be included in a report template
- Copy window to clipboard

9.1 About the Interface

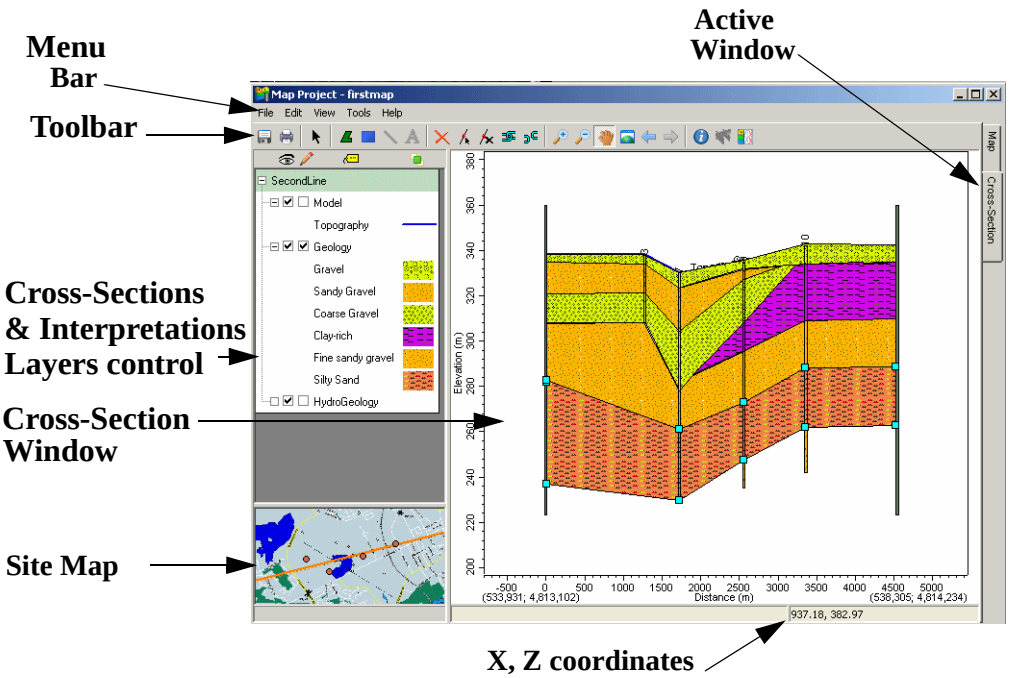
The Cross Section Editor may be launched from HydroGeo Analyst in several ways:

- Select a cross section from the Cross Sections node, then click **Tools > View Cross Section** from the HydroGeo Analyst main menu;
- Select a cross section from the Cross Sections node, then click on the **Show/Create Cross-Section** button on the toolbar;
- In the Project Browser, double click on an existing cross-section from the Cross Sections node;

The Cross Section Editor may also be launched from the Map Manager in one of the following ways:

- Activate the Cross-section lines layer from the layer manager, and select a Cross section line by clicking on the desired cross-section.
  - To create a new cross-section, select the **Create Cross Section** menu option from the **Tools** menu, or click on the **Show/Create Cross-Section** button on the toolbar. This option will create a new cross-section based on the selected cross-section line.
  - To open an existing cross-section based on an existing cross-section line, click on the **Show/Create Cross-Section** button on the toolbar. This opens the cross-section editor with the corresponding cross-section.
- Click on the **Cross-Section** tab, in the upper right corner of the window (see figure below) to activate an existing cross-section from a list of cross-sections that are available for your project.

The **Cross Section Editor** window is shown in the figure below (with a cross section loaded for demonstration purposes).



The Cross Section Editor window contains the following items:

- **Menu Bar**: Contains program menu commands
- **Toolbar**: Contains short cut buttons to some of the most commonly used features in the Cross-Section Editor.
- **Layer Control**: Manages cross-sections, visibility, and editability of interpretation layers. Right-click a layer to access additional options such as Move up/Move down, View 3D and Properties.
- **Cross-Section Window:** Contains the cross-section view for the selected cross-section line.
- **Site Map**: Displays the selected cross-section line, as it appears in the map project. The selected stations for the cross-section are highlighted in this Map preview window.
- **Coordinates:** Displays the X, Z coordinate for the current mouse cursor location.
- **Active Window:** Select between the Map Manager window and the Cross Section window.

9.1.1 Description of Toolbar Items

The Cross section editor contains a toolbar with short cut buttons to some of the

commonly used features. Most toolbar buttons are context sensitive, and react according to the active layer, window, or dialog. If there are no options for the selected layer, the respective toolbar button(s) will become inactive, indicated by a greyed out appearance. For example, the option to add a vertex is active only when a polygon or a line is selected.

Save button saves the current cross-section project.

Print button sends the current cross section view to the report editor.

Selection Pointer feature is used for selecting objects in the active interpretation.

Draw Polygon feature is used for drawing a polygon or a rectangle in the active layer.

Draw Line feature is used for drawing a model layer line in the selected layer.

Add Text features is used for adding annotation to the selected layer.

Delete Selected Object feature deletes the selected object (shape) from the currently activate layer.

Add Vertex feature is used for adding a vertex to the selected object (polygon or line). This button is activated only if an object is selected.

Delete Vertex feature is used for deleting a vertex from the selected object (polygon or line). This button is activated only if an interpretation having at least one object is activated, and at least one of the objects is selected.

Link Vertex feature is used for linking two vertices from two polygons or lines. This feature is only available if an interpretation having at least two polygons or lines is activated, and at least one of them is selected.

Remove Links feature is used for breaking the vertex link between two or more polygons or lines. This button is activated only if an interpretation having at least one object is activated, and at least one of the objects is selected. For more information, see “Link Vertex” on page 325

Zoom In option is used to zoom in on an area of the cross-section, defined by a rectangle.

Zoom Out option is used to zoom out from the current cross-section view.

Pan button allows the user to pan the current view left, right, up, or down.

Full Extent button restores the cross-section view to the full extents of the Cross-Section’s coordinates.

Previous Extent button restores the cross-section view to the previous zoom extent.

Next Extent button switches the cross-section view to the next zoom extent.

Information button displays information for the selected station. Moving the mouse cursor overtop of a station will display the information.

View 3D button loads selected cross-section(s) into 3D Explorer.

View BHLP button loads a BHLP for the selected station.

9.2 Description of Menu Items

9.2.1 File

Save

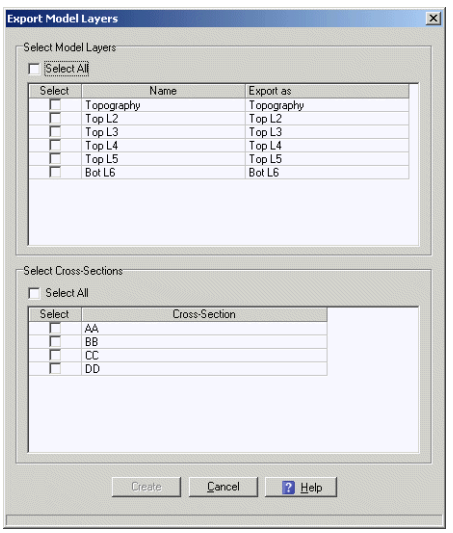
This menu item will save all current edits for the cross-section to the current cross-section project file (.VCP).

Close

Closes the currently open cross-section.

Export Model Layers

This option allows you to export the model layer lines for all cross sections, to XYZ text file format. These files can in turn be used to define layer elevations in groundwater flow models, such as Visual MODFLOW. When this option is selected, the following dialog will appear:



In this dialog, select the model layers you wish to import. Each model layer will be exported as a separate file; for each file, you may define the name under the **Export As** column.

Next select which cross sections should be considered in the export. Click the **[Create]**

button to generate the files. The files will be generated in the **Model** sub-folder, of the Project folder (for example:

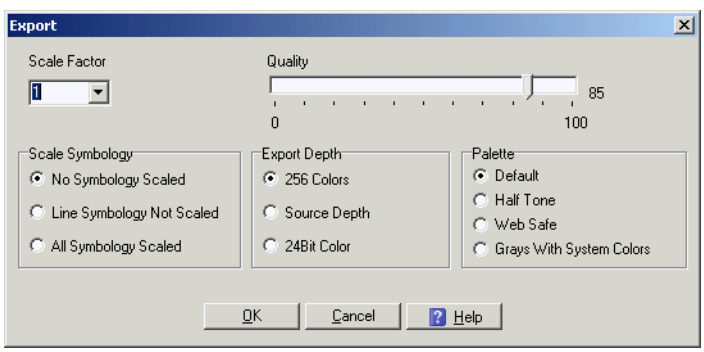
D:\Program Files\HGAnalyst\Projects\Demo_Project\Model\Topography.txt)

The Cross Section editor will generate the text files based on the vertex location of each model layer line, in each cross section. For example, for model layer 1 (Topography), if cross section AA' contains this model line with 5 vertices, and cross section BB' has the same model line with 10 vertices, then the text file should contain 15 rows (if both cross sections AA' and BB' are selected).

The X,Y location for each vertex corresponds to the X,Y location on the cross-section line; the Cross-Section editor also provides the option to save the well contacts using the station's X,Y co-ordinates, and retrieve this info from the database. For more details on this feature, please see "Interpretation" on page 337 and see "Querying Cross Section Interpretations" on page 353.

Export Image

Provides options for exporting the current cross-section to a Raster Image file. Supported file types include: bitmaps (*.BMP), Joint Photographic Experts Group (*.jpg), and enhanced Meta Files (*.EMF). Enter a filename, and choose the desired export format, and click **[OK]**. An Export dialog will appear with settings for the image file:



There are several options for the modifying the image provided in this dialog:

Scale Factor: Choose a scale factor from the combo box. This factor will determine the resolution of the exported image. The greater the factor the better the resolution will be.

Quality: Using the scroll bar, define the image quality. This option is available only if the JPEGs export format is selected. The greater the percentage the higher the quality will be. The image size is also directly proportional to this value.

Scale Symbology: Determines if the scale factor will be applied to symbols and lines.

Export Depth: Choose the color quality for the exported image.

Palette: Determines the color palette to be applied to the exported image.

The Palette and Color Depth options are available only for bitmaps (.BMP) and enhanced Metafiles (.EMF).

Print

Loads the current cross-section into the report editor's runtime designer. Please refer to Chapter 11: The Report Editor for more details on managing reports.

Exit

Exit the Cross Section Editor, and return to the main window of HydroGeo Analyst. Note that this menu option also closes the map manager.

9.2.2 Edit

Delete

Deletes the selected object.

Delete All

Deletes all shapes from the currently active cross-section interpretation.

Add Vertex

Provides an option to add a vertex to the selected object. To add a vertex:

- Activate the desired cross-section interpretation (make it editable);
- Select an object that is a polygon or a line (depending on the active interpretation type);
- Click on the button or select the **Add Vertex** option from the **Edit** menu.
- Place the mouse cursor at the desired location; the mouse cursor will change to a pen;
- Click once with the left mouse button at this location to add a vertex;
- Repeat the last two steps to add more vertices at other locations on the selected object.

Delete Vertex

Provides an option to delete a vertex from the selected object. To delete a vertex:

- Activate the desired cross-section interpretation;
- Select an object that is a polygon or line;
- Click on the button or select the **Delete Vertex** option from the **Edit** menu.
- Place the mouse cursor on the vertex to be deleted; the mouse cursor will change to an “X”;
- Click once with the left mouse button on this vertex to remove it from the object;
- Repeat the last two steps to delete more vertices from the selected object.

Link Vertex

The Link Vertex option allows for linking two vertices from two polygons or lines. It is intended to assist in filling in gaps between adjacent polygons (or lines), thus creating continuous interpretations. The end result is that polygons (or lines) will be able to share a common “linked” vertex (or vertices).

To Link Vertices on polygons (or lines),

- Select the desired interpretation layer and make it editable;
- Select the polygon or line whose vertex will be linked with another vertex;
- Click the **Link Vertex** option from the **Edit** menu or click the button from the toolbar.
- Click on the desired vertex (source vertex) that will be linked with another one; the color of the vertex changes to green to indicate it has been selected;
- Move the mouse cursor to the desired destination vertex, to which the previously selected vertex will be linked. The mouse cursor will change to a red square outline, when a vertex is identified;
- Click on this red square, and the vertices will be linked.
- The Linked Vertex will turn orange to indicate that the vertex is linked, and shared by two or more polygons (or lines).

NOTE: “Link Vertices” option is activated only if there are at least two objects on the layer. Once two vertices are linked, they behave as a single vertex.

Remove Links

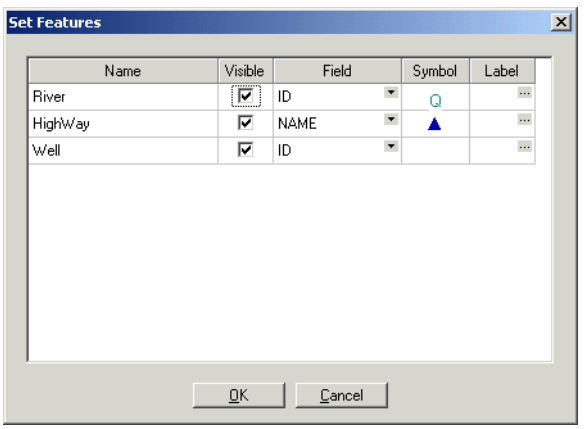
The Remove Links option allows for separating previously linked vertices.

To use this option,

- Select the interpretation layer containing at least two polygons or lines whose one or more vertices are linked;
- Make this layer editable;
- Click the **Remove Links** option from the **Edit** menu or click the button from the toolbar;
- Click on one of the linked vertices in the selected polygon; linked vertices are colored orange;
- Upon clicking on a linked vertex, the vertex will change back to blue color to indicate that the link has been successfully removed;
- Click on the pointer button in the toolbar;
- Place the mouse cursor on this vertex which has been separated;
- Click once on this vertex, and drag the mouse away from its position, and place the polygon vertex in the new position (if desired);

Set Features

The Set Features option allows for modifying the display properties of most layers in your map project and other cross sections that intersect with the current cross section. If this option is selected from the **Edit** menu, a dialog similar to that shown below will be displayed.



A cross section line may intersect with one or more features that are displayed in one or more layers in your map project. For instance, one or more rivers from the “Rivers” layer may intersect with a given cross section at one or more points. Other features of importance may include roads, railway lines, lakes, etc. Features from selected map layers that intersect with a cross-section may be displayed as a symbol and/or label on

the cross-section line.

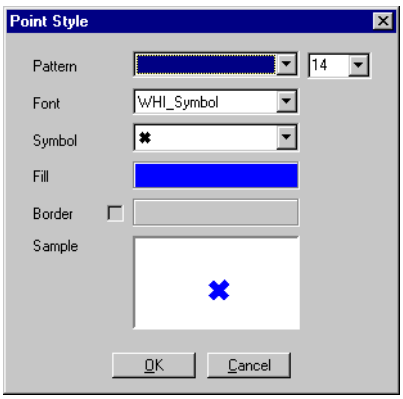
NOTE: The intersecting items display options can be defined only at the time when the cross section is created; currently, it is not possible to set these features later on, once the cross section has been created. Also, intersecting items must be selected in **Map Manager** before the cross section is created (Please see Section 8.2.7 for more details)

In the Set Features dialog, there are several options:

- **Name**: Name of the intersecting layer (read-only)
- **Visible**: Defines if the element is visible or not.
- **Field**: Allows you to select a field to use as a label for the intersecting feature
- **Symbol**: Allows you to select a symbol to represent the intersecting feature
- **Label**: Allows you to set properties of the label representing the intersecting feature

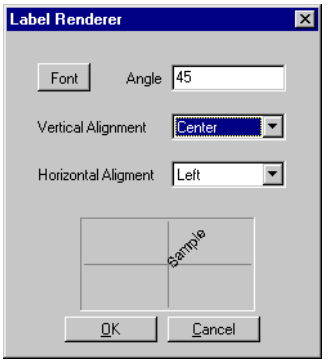
The **Field** column contains a list of available fields for the selected layer. This field will be used as the label in the cross section view.

Double-click on the desired cell in the Symbol column to load the dialog where a symbol can be selected and its properties set.



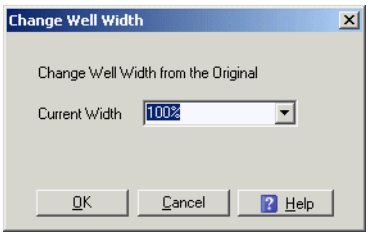
NOTE: You will only be able to change the **Font** and **Symbol** of the point if the **Pattern** is set to “True type”.

The **Label Properties** dialog may be loaded by selecting the **[...]** button; the properties that are available are shown below.



Change Well Width

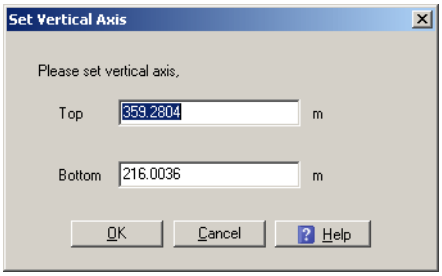
Provides options for increasing the display width of stations (wells and boreholes) plotted on the cross-section.



You can change well width as it appears on the screen by a factor displayed in the “Current width” drop-down menu. Using this factor, you can make the wells thinner or thicker on the cross-sectional display.

Change Vertical Axis

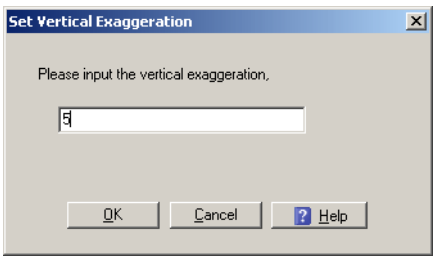
This option allows you to extend the vertical range of the elevation axis. When this option is selected, the following dialog will display:



Specify a **Top** value and a **Bottom** value. Click **[Ok]** to accept the new values.

Change Vertical Exaggeration

This option allows you to change the vertical exaggeration of the current cross-section. The vertical exaggeration is simply the ratio of the vertical scale to the horizontal scale.



Specify a new vertical exaggeration and click the **[Ok]** button. The cross section will then be regenerated to reflect the new vertical exaggeration.

Copy Window

Provides an option for copying the current cross section window to the Windows clipboard. The window may then be pasted into a supporting application (such as a document, or image editor, or slide presentation).

9.2.3 View

This menu provides options to modify the appearance and size of the Cross Section Window.

Full Extent

This menu item will result in zooming out the cross-section window to its original full extents.

Zoom In

Provides options for zooming into a section of the cross-section that is defined by a rectangle drawn around the desired area. Place the cursor on the cross-section and click once to define one corner of the rectangle, drag to a second position to define the opposite corner of the rectangle, and release the mouse button. The selected section will be adjusted to fill the screen.

Zoom Out

Provides options for zooming out on the cross-section. Click this menu item and the cross-section window will zoom out. The current screen will be zoomed out by a factor of two unless it is not already in a full-extent mode.

Previous Extent

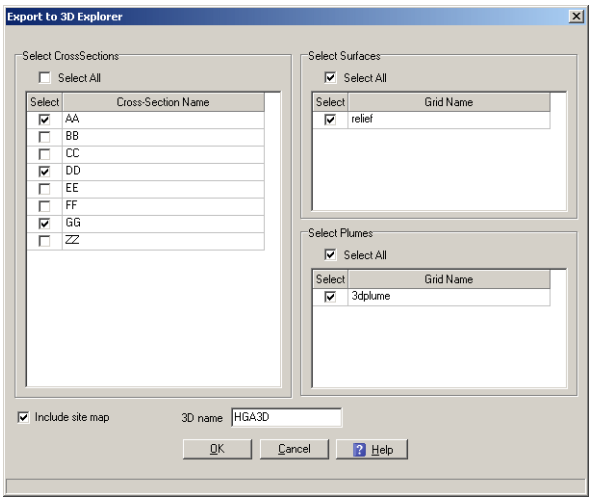
Zooms the cross-section window to the previous window dimensions.

Next Extent

Zooms the cross-section window to the next window dimensions.

View 3D

Allows you to view one or more cross sections in 3D, with the 3D Explorer. Upon selecting this menu item, the following dialog will appear:



- ☞ Select the **Cross sections** to display from the dialog, by placing a check mark beside each cross section name. Or, to select all cross sections, place a check mark beside the **Select All** check box at the top of the dialog.
- ☞ Select any **Surfaces** you wish to be displayed with the cross sections in the same manner. Gridded surfaces can be created in the Map Manager; see Chapter 8: Create Gridded Data for more details.
- ☞ Select any **Plumes** you wish to be displayed with the cross sections in the same manner. Plumes can be created in the HGA main window; see Chapter 3: 3D Interpolation for more details.

When you are finished,

- ☞ **[OK]**

This will load the 3D Explorer window. For more details on how to use 3D Explorer, please refer to Chapter 10: HydroGeo Analyst 3D-Explorer.

Information

Provides a window containing information on the selected station. After selecting this option, you may place the mouse cursor on a particular lithologic column within a selected station. A small text box appears displaying specific information about the layer (layer type, top and bottom elevations, and thickness). If the station in question has screens, the **Information** feature can also highlight their pertinent features.

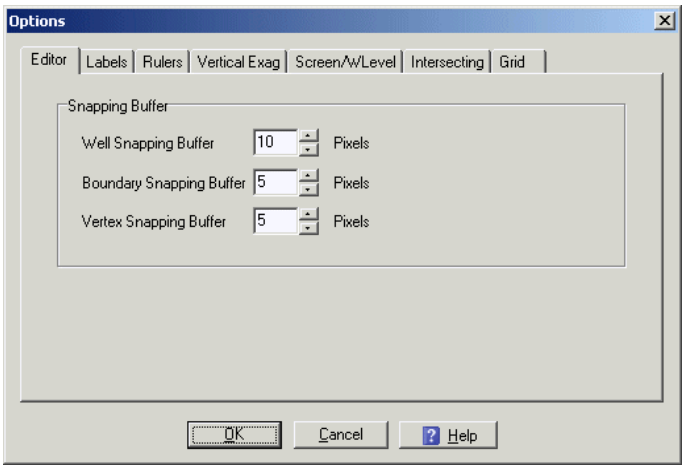
Preview BHLP

Allows you to view the borehole log plot (BHLP) of any station in the cross section. To view the BHLP, select this option and click on any station in the cross section.

9.2.4 Tools

Options

Allows setting line snapping options for lines drawn on the cross section. If this feature is selected, the dialog shown below will appear.



Editor Tab

In this tab, there are options for specifying the snapping buffers for the selected cross section and its elements. The Snapping Buffers are specified in pixels. The buffer values determine the distance to which lines and vertices will snap (i.e. join) to the nearest line or vertex. If a low value for the Snapping Buffer is specified, the mouse cursor must be very close to a vertex or line in order for snapping to occur. If a high value for the Snapping Buffer is specified, then snapping will occur at a distance further away from the destination vertex (or line).

Snapping allows for exact placement of vertices, and eliminates the need for repetitive use of zooming in to specific locations. If the snapping is used, the vertices will be connected (but not linked) at the desired locations.

Well Snapping Buffer

The default Well Snapping Buffer is 10 pixels. When a line is drawn, and the mouse cursor comes within 10 pixels of another well (borehole), then the borehole will be highlighted; upon clicking the left mouse button on this station's lithologic interval, the line will be automatically snapped to the closest vertex.

Boundary Snapping Buffer

The default Boundary Snapping Buffer is 5 pixels. When a line is drawn, and the mouse cursor comes within 5 pixels of a cross-section boundary line (either the left or right), then the boundary line will become highlighted; upon clicking the left mouse button on this boundary line, the drawn line will be automatically snapped to this boundary line.

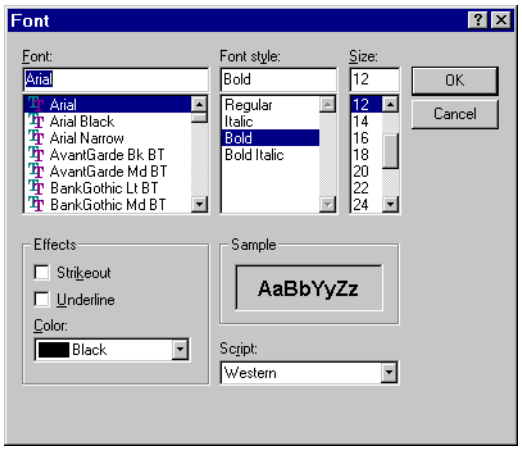
Vertex Snapping Buffer

The default Vertex Snapping Buffer is 5 pixels. When a vertex on a polygon is selected, and the Link Vertex option is used, and the mouse cursor comes within 5 pixels of a vertex on an adjacent polygon, then the vertex will become highlighted with a red box

outline; upon clicking the left mouse button on this vertex, the vertex on the selected polygon will be automatically snapped to this newly selected vertex. Polygon Vertex Snapping makes it easy to place polygons adjacent to one another, for continuous cross-section views.

Labels

Provides options for modifying the label fonts for the interpretation layers (Geology, Hydrogeology, and Model). Simply click on the sample box beside the appropriate label, and a Font options dialog will appear as shown below.



Define the desired font settings, then click **[OK]** to return to the Options dialog.

Rulers Tab

Controls the appearance settings for the axis of the cross section plot. For each ruler (vertical and horizontal) you may define:

- **Foreground Color**
- **Background Color**
- **Marker Width**
- **Min Tic Pixels**
- **Tic Numbers**
- **Font**

Vertical Exaggeration

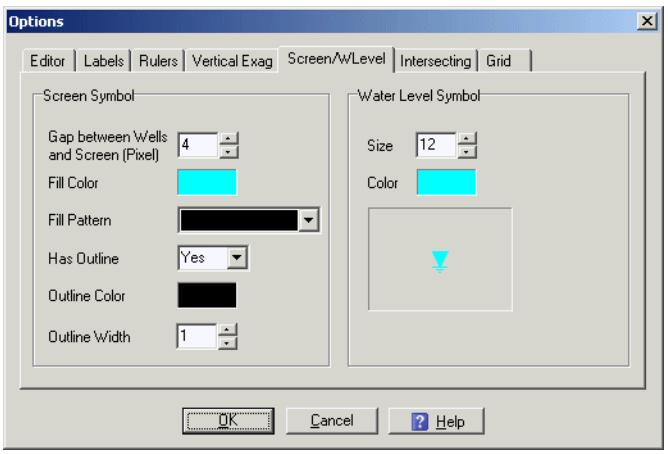
Define the vertical exaggeration scaling factor for new cross-sections. There are two options: Default value, or User-defined (Specific). If the default option is selected, the map manager will automatically calculate and assign the most appropriate vertical

exaggeration factor.

NOTE: Please see “Change Vertical Exaggeration” on page 329 for information on how to change the vertical exaggeration once a cross-section has been created.

Screen / Water Levels

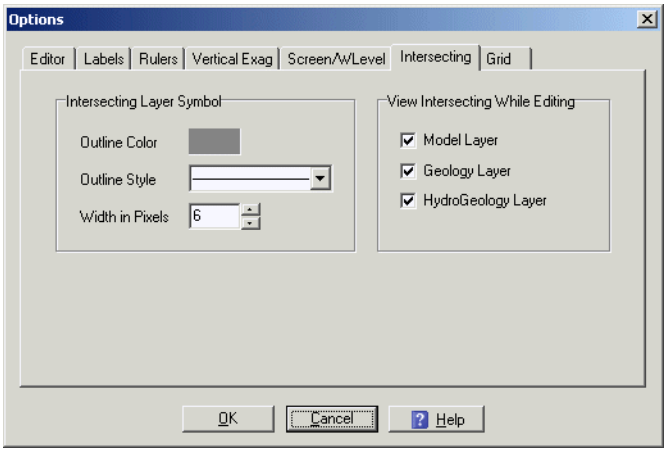
Controls the appearance settings for how screens and water levels are displayed on the cross section. These options are shown below



In this dialog, there are options for the view settings (color, style, etc) for both the screen and the water levels. The “Gap between Well and Screen” controls the distance between the station and where the screen is placed. The larger this Gap value, the further away the screen will be from its respective station.

Intersecting Layers

During a cross-section interpretation, knowledge of other interpretations is essential. In this dialog, you can define display options for intersecting cross sections.

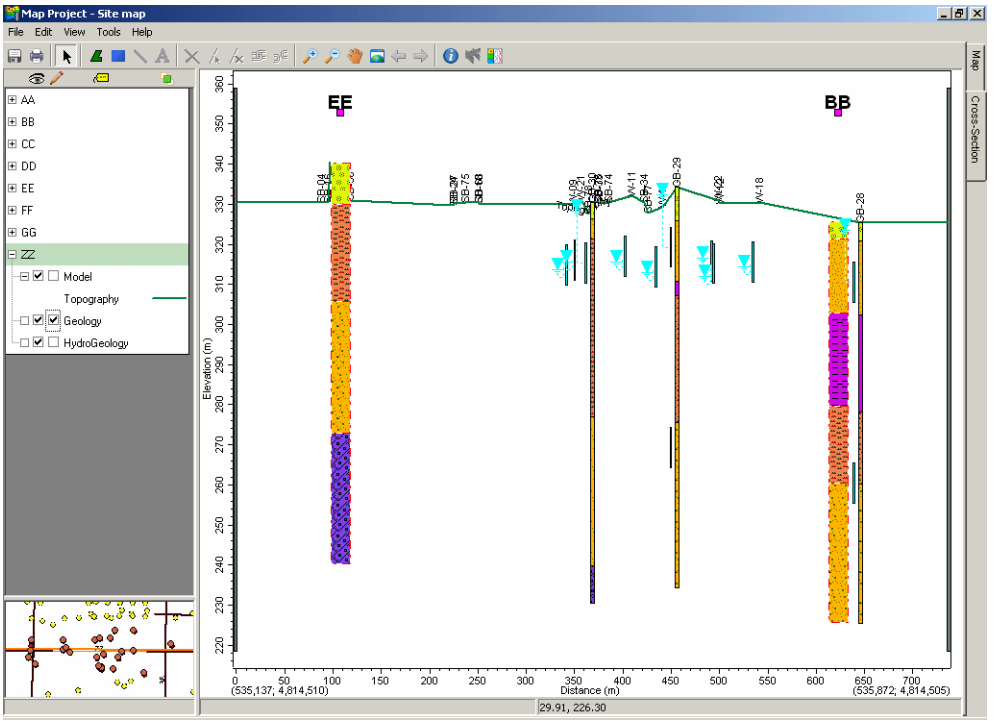


Specify the color and line style under the **Intersecting Layer Symbol** frame. In the **View Intersecting While Editing** frame, specify the view options for different interpretation types. By default, all modules will be active.

The intersecting cross-sections will be visible when you set one of the interpretation types to visible, and editable. In the example screen shot below, you can see that cross-sections EE and BB along with their interval locations, are visible while interpreting cross-section ZZ:

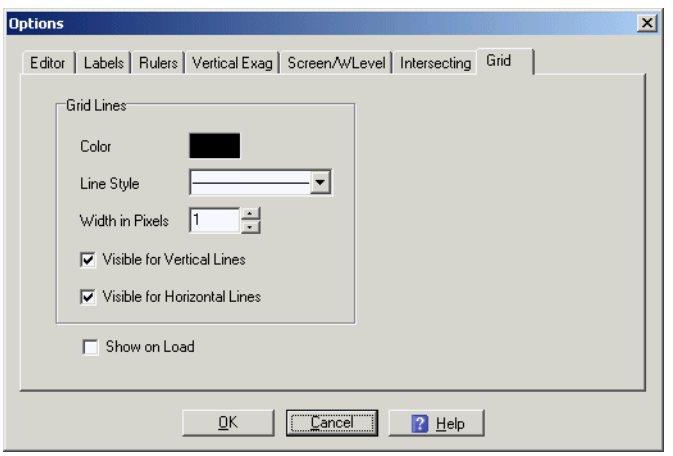
Scale

Specify a new view scale. More to come with GUI



Grid

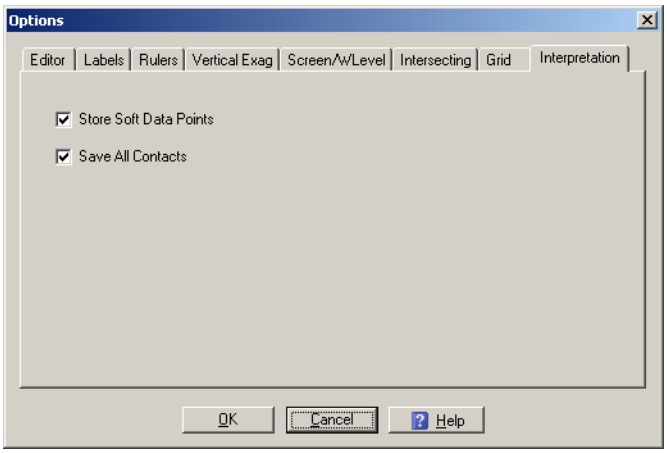
Set the display properties for grid lines in the 2D cross section view.



In the **Grid Lines** frame, set the line style, color and width, and also set visibility settings for the horizontal and vertical grid lines**.** The **Show on Load** option will result in the grid being displayed each time the cross-section is loaded.

Interpretation

Define the data storage options for cross-section interpretations.



The cross-section editor now saves the cross-section interpretations to the project database. The interpretations are also linked to the stations that were selected for the cross-section, and these stations, along with their interval data, are also saved to the database. The interpretations, and the wells and corresponding interval data, can be retrieved later, using the Query Builder. For more details, please see “Querying Cross Section Interpretations” on page 353.

Store Soft Data Points

Whenever a layer intersects with a station at only one point, it could be because of one of the following reasons:

- The layer truly touches the well at only one location (e.g. pinch-out), or
- There is no contact with the well

In either case, the following options are available:

- Consider the actually intersecting point as the top elevation and insert NULL for both the thickness and bottom elevation
- Extend the depth of the station fictitiously (within the bounds of the cross-section) to determine the location of the other point. These extensions are known as **Soft Data Points**. If this point can not be found within the bound, the layer will be considered to be a zero thickness layer (with thickness of NULL).

Save All Contacts

Some stations may be crossed by a layer but may not be involved in the interpretation

(e.g. bad wells or data in those wells did not make sense, etc.) and as such, the following options are available:

- Consider all intersection points as valid contacts; this is the option **Save All Contacts**
- Only store contacts where there are vertices within the well (e.g. user snapped to intervals or clicked within a well and created a vertex). To do this, disable the option **Save All Contacts**

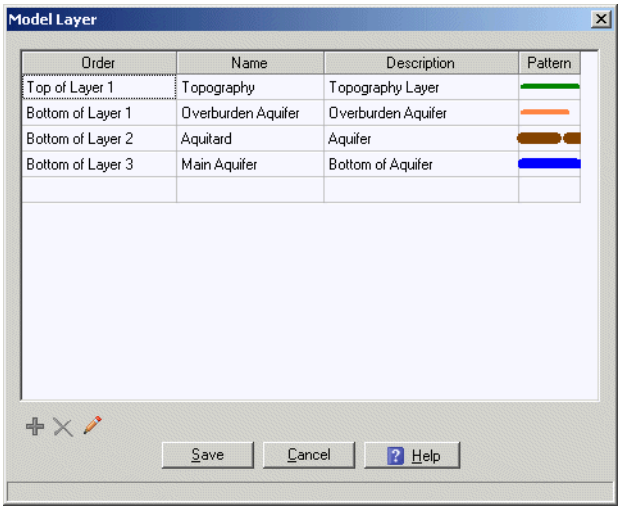
Limitations

Although the cross-section component currently allows creating complex, overlapping, zig-zagging interpretations, these types of interpretations are not suitable for the purpose of saving (and later querying) in the database. As such, the following rules/ limitations are enforced to avoid saving such results in the database:

- A given layer may not be allowed to intersect a given station more than twice. When this rule is violated, HGA will consider the two top-most intersection points as defining the layer
- All layers in a cross-section must be uniquely identified by the layer name. HGA may pick the top most layer and ignore all other layers with the same name.
- If a station is removed from a cross-section, related saved interpretations (contacts) are removed as long as this station is not involved in any other cross-sections;
- If a layer is deleted from a cross-section, all related interpretations (contacts) are removed from all stations that are involved in the cross-section as long as this layer does not appear in another cross-section for any of the stations involved in the current cross-section;
- If a given well appears in more than one cross-section, interpretation results are updated with interpretations from the cross-section that is last updated.

Model Layers

Before drawing model layers, the model layer attributes must first be defined in the dialog shown below. Model layers can be added, deleted, or edited in this dialog.



In the **Model Layers** dialog, there are four columns:

- **Order**: Layer order, from top to bottom (read-only)
- **Name**: Defines the layer name
- **Description**: Defines layer description
- **Pattern**: Defines line properties for the model layer

In this dialog, specify the total number of model layers, and the properties for each layer. Layers will be ordered from top to bottom; the first layer will always be Top of Layer 1 (i.e. Ground surface), followed by Bottom of Layer 1, Bottom of Layer 2, and so forth. The top most layer represents the top surface for the first layer while the bottom most layer represents the bottom surface of the last layer. (i.e. each model line defines the bottom of the model layer (excluding the top layer)).

Additional model layers may be inserted at any location, at any time.

- Press the (Add) button to add a new model layer. The new layer will be added ABOVE the currently selected layer.
- Press the (Delete) button to remove the selected model layer.
- To edit an existing layer, press the (Edit) button or double-click on the row containing this layer.

Each model layer does not need to appear in all cross sections.

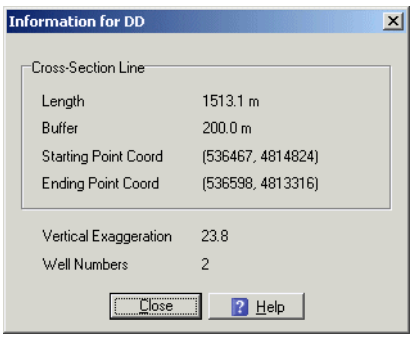
NOTE: The Model Layers options are not available when the Model Layer interpretation is set to edit mode in the layer manager.

Update Cross Section

Use this option to update the screen, water level, and intersecting layer information displayed on the current cross section. The corresponding map project should be open in order to update information from intersecting cross-sections.

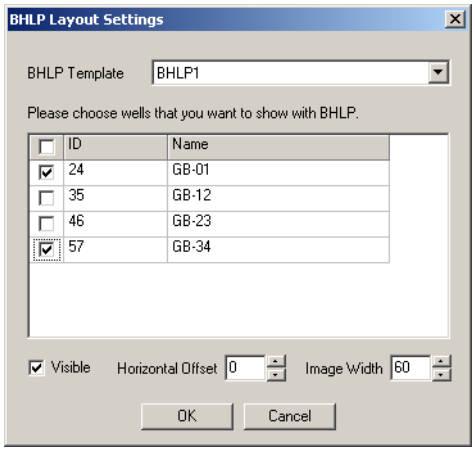
Cross Section Info

Displays summary info for the selected cross section.



Display BHLP

Use this feature to display a borehole log plot directly on the selected cross-section; when displaying elements such as geophysical plots and well screen intervals, the borehole log plot can be a valuable asset when creating a cross-section interpretation. The BHLP layout settings is shown below:



In the BHLP Layout Settings dialog, there are several display options available:

- **BHLP Template**: select the desired BHLP template from the list.
- **Visible**: show/hide the BHLP on the cross-section
- **Horizontal Offset**: set the horizontal position of the BHLP; a positive offset will shift the BHLP to the right of the selected well; a negative offset will shift the BHLP to the left of the selected well.
- **Image Width**: set the width of the BHLP image

In the grid in the middle of the dialog, select which stations should display the BHLP on the cross-section; selecting too many stations may result in a crowded display.

9.2.5 Help

Contents

Launches HGA Help, placing the focus on the Cross Section Editor section.

9.3 Creating the Cross Section

As mentioned earlier, cross-section locations must be drawn using the **Define Cross-Section Line** option, or the **CrossSection Line** button ( ) in the Map Manager. See Chapter 8: Defining a Cross Section Line for details on this procedure.

Once the cross-section line is defined, the corresponding cross-section can be created from the Map Manager, as follows.

- In the Map Manager, select **Tools > Create Cross Section** from the main menu, or click on the **Show/Create Cross-Section** button on the toolbar.
- Click **[Yes]** to create the cross-section; the name assigned to the cross-section

line will be used as the cross section name.
- If surface layers are present in your Map Project, you will be prompted to select a surface layer. Please see “Loading Surface Layers” section, on page 342.
- The cross-section editor opens the selected cross-section and displays the stations and related information.

The cross-section shows projections of the borehole lithologic columns on the cross-section plane. By default, the top of model layer 1, ground surface, will be drawn in for you. The starting point of the cross section line will appear on the left side of the cross section window; the end point of the line will appear on the right side of the window.

Locations for layers must be interpreted, and drawn manually using lines or polygons; layer types may be Geologic, Hydrogeologic, or Model

The process of drawing layers is described in the next section.

NOTE: Each Cross-Section has required fields which must be present in your database structure, as defined in the **Profile Settings**. For more details, see Chapter 5: Profile Settings.

9.4 Drawing Cross-Section Interpretations

Interpretation of the cross-section is a considerably creative process, however the cross section editor makes it easy for you. Once the selected stations have been loaded into the cross section editor, the appropriate layers must be manually drawn, and interpreted. Start the interpretation by selecting the layer type from the layer manager. Choose from Geologic, Hydrogeologic, or Model. Each of these is explained below.

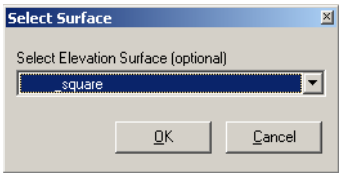
Hydrogeologic interpretations can be copied from geologic interpretations. As such, it is a better practice to first perform geologic interpretations of the cross-section.

9.4.1 Loading Surface Layers

Surface layers (e.g DEM, Surfer GRD) in a Map Project can be used to generate a detailed topography model line for a cross-section.

Note: A surface layer can only be defined for a cross section line when the cross section is being created, in the Map component of Map Manager. Please refer to the “Surface” section, on page 266 for information on how to import a surface layer into a Map Project. Also, please see the “Create Cross-Section” section, on page 302 for information on how to create a cross section.

When a surface layer is present in a map project, you will be prompted to select a surface layer when creating your cross section line. The following dialog will display:



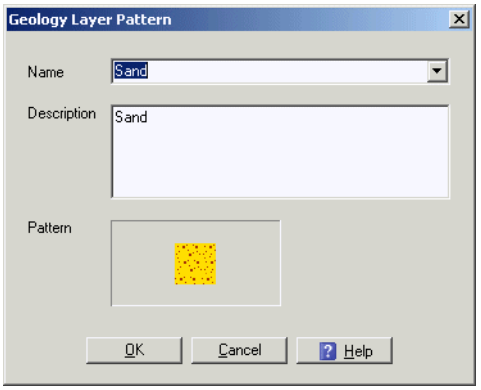
This dialog contains all of the surface layers currently present in your map project. Select a surface from the dropdown list box and click **[Ok]** to create the cross section. Be sure to select a surface layer that covers the full extent of the cross-section line. Leave this dialog blank if you do not wish to use a surface layer.

9.4.2 Geologic Layer Interpretations

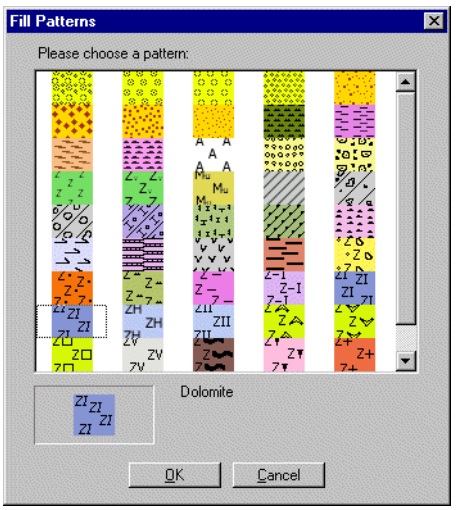
This option allows for drawing interpretation layers that assist in defining the geology (sand, clay, till, bedrock, etc) at the site. To draw Geologic interpretation layers, the polygon draw tool must be used, and the polygon must be digitized manually using the mouse.

Follow the directions below:

- Activate (make it editable) the Geology interpretation from the layer manager;
- Select the (Polygon) button from the toolbar
- Place the mouse cursor at the desired location of the first vertex of the intended geology layer;
- Click once on the left mouse button to add a vertex and start digitizing the polygon in the desired direction;
- Add more vertices by clicking on the left mouse button at desired locations. Move the mouse cursor to an interval on a desired station; the mouse cursor will snap the vertex of the polygon to the nearest station interval. A vertex can also be added anywhere on the cross-section by clicking on the left mouse button.
- Double click anywhere on the cross-section using the left mouse button to close the polygon; the following dialog will appear:



- In the dialog that appears, enter a **Name** for the layer, a brief **Description**, and select a soil **Pattern**. If the geologic layer you have just digitized in the current cross-section has already been created, you may select it from the list, instead of typing a new name. Click on the blank area beside **Pattern** to load the pattern options, as shown below:



- Select a pattern, then click **[OK]**

Repeat the same sequence of operations for other layers within the active cross-section. The result will be a layered structure of the geological domain. The cross-section may contain some gaps where polygons do not completely touch adjacent polygons; this can be easily fixed by selecting a vertex on a polygon, and using the pointer tool to re-

position the vertex. Alternately, gaps between polygons can be filled by using the **Link Vertex** option. These options are explained below.

Once a layer is created in one cross-section, it will be available for selection in all other cross-sections that you might have for your project. Altering the properties of a given layer will be reflected in all cross-sections.

Editing Layers

Once the interpretation layers are drawn, it may be necessary to modify the positions of one or more vertices, or fill in the gaps between any two adjacent layers, to create a continuous layered structure.

To move a vertex,

- Select the (pointer) tool from the toolbar
- Click on one of the vertices of the polygon
- Drag the vertex to a new location.

To add a vertex,

- Select the (pointer) tool from the toolbar
- Click once anywhere on the polygon to activate the object
- Select the (Add Vertex) tool from the toolbar
- Place the mouse cursor at the desired location; the mouse cursor will change to a pen
- Click once with the left mouse button at this location to add a vertex

Geologic interpretation layers can have a free form, and do not have to conform to a conceptual model (e.g. a sand layer may appear more than once in an individual cross-section). Layers may not have to continue from first to last borehole. However, to have a meaningful view of your cross-sections in the 3D Explorer, you must avoid creating overlapping interpretation layers.

When defining Geologic interpretation layers, there is an option to snap the vertices of one polygon to adjacent polygons. For instance, if after drawing polygons and the cross section still contains gaps, the gaps may be filled in by linking the vertices of the polygons, using the Link Vertex option.

To use this option, please refer to the “Link Vertex” section, on page 325 in the **Edit** menu.

NOTE: Moving a vertex of a selected polygon will also move the linked vertex of any polygons (or lines) that might have been linked through the “Link Vertices” operation.

9.4.3 Hydrogeologic Layer Interpretations

This option allows for drawing layers that define the hydrogeologic layers (Aquifer1, Aquitard1, Upper Unconfined Aquifer, etc.) based on relevant data in the stations that are displayed in a cross-section. The hydrogelogic layers must be drawn using the polygon tool.

The procedure for drawing and editing these layers is identical to drawing geologic layers, as explained above.

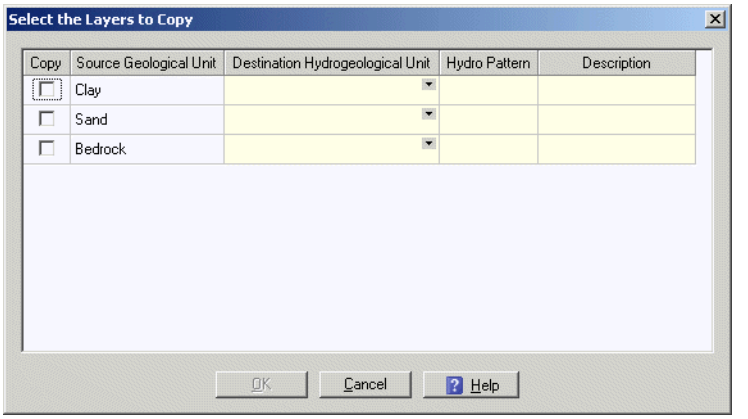
The position of the hydrogeologic interpretation layers may be defined based on the position of any Geological interpretations that may already be available. This option is discussed below.

Translating Geologic Interpretations into Hydrogeologic Interpretations

A hydrostratigraphic unit will generally include one or several geologic layers and the boundaries of a hydrostratigraphic unit will usually conform with the boundaries of the geologic layers. As such, you can copy one or more of your geologic interpretation layers and use them as a startup for hydrogeologic interpretation layers.

To do so,

- Select the **Hydrogeology** option from the Layer Manager, to make this layer visible
- Right mouse click on this interpretation layer, and select **Copy from Geologic Layers**, and the following dialog will appear:



- In this dialog, select one or more geologic interpretation layers to copy
- For each layer to be copied, provide the name, pattern and description of the

corresponding hydrogeologic interpretation layer (Aquifer or Aquitard)

Once this is complete, the cross-section editor draws the selected hydrogeologic interpretation layers.

9.4.4 Model Layer Interpretations

This option allows for defining the unique model layers (Model Layer 1, Model Layer 2, etc.) for the displayed stations. Model layers can be used for numerical groundwater flow models, or for general purposes. The layer positions for model layers must be drawn in manually with the mouse, using the Line tool.

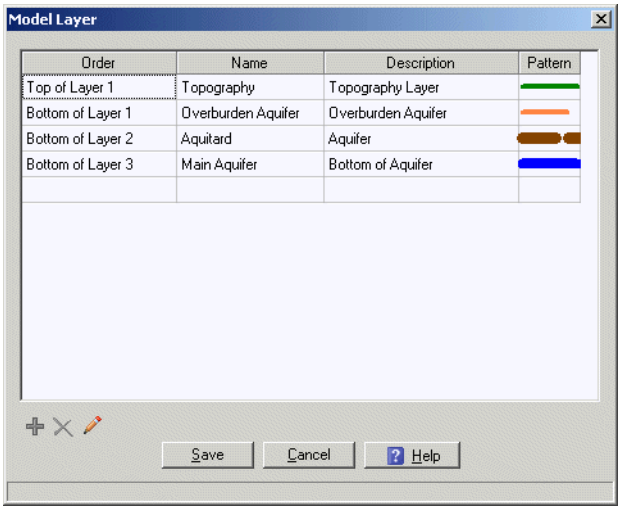
Defining Model Layers

Before drawing model layers, the layer attributes must first be defined.

To do so,

- Select **Tools > Model Layers** from the main menu

This will load the **Model Layers** dialog as shown below.



In this dialog, you can specify the total number of model layers, and set properties for each layer. In addition, the layers can be numbered in a particular order. Layers will be numbered starting with 1 for the top most layer and increase with depth. The top most layer represents the top surface for the first layer while the bottom most layer represents the bottom surface of the last layer. (i.e. each model line defines the bottom of the model layer). Once the layers have been defined, additional layers may be inserted at any location, at any time.

Please refer to the section “Model Layers” section, on page 338, for more details.

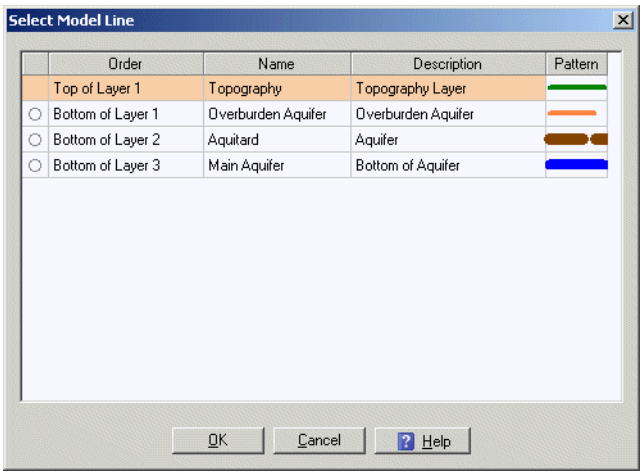
Drawing Model Interpretation Layers

Before starting to draw model interpretation layers, please ensure that you have defined the model layer settings explained in the previous section.

You will see that the top of layer 1 (ground surface) is drawn in automatically for each new cross section.This layer can be modified by moving it through its existing vertices, adding new vertices at desired locations or deleting existing vertices.

To draw model layers, follow the directions below:

- Activate the Model Interpretation Layer in the Layer Manager;
- Select the Line draw button from the toolbar. As soon as this option is selected, the following Model Layers dialog will appear

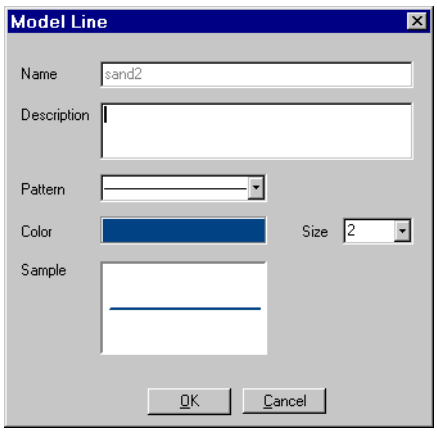


- In this dialog, choose the desired model layer by selecting the radio button from the first column in this grid. Each model layer may be selected and assigned only once. Interpretation layers that are already drawn in the cross-section are colored in orange and are not selectable.
- Click **[OK]** to continue
- Place the mouse cursor at the left boundary at the desired depth of the intended model layer; when the mouse cursor becomes close enough to the boundary line, the cursor will snap to the boundary.
- Click once on the left boundary to add a vertex at this location, and start the line
- Slowly move the mouse cursor (to the right) across the cross-section to the interval in the first station which represents the model layer. When the cursor is within the specified buffer distance from the station's lithology interval, snapping will be activated.
- With a left mouse click, add a vertex at desired and appropriate locations both within and outside station intervals.

- Continue to move the mouse cursor across the cross-section, using the left mouse button at each station to add a vertex at the desired location for the model layer
- At the right cross-section boundary, click once more with the left mouse button to add a vertex and complete the line; when the mouse cursor becomes close enough to the boundary line, the line will snap to the boundary. The selected model line will be drawn at the specified location.

NOTE: The model line is drawn using the attributes that were defined for it at the time it was created. Most attributes of a model interpretation layer can be modified by right-clicking on the desired model interpretation layer and choosing **Properties** from the pop-up menu.

- A dialog similar to that shown below will appear.



- Provide a Description, Line Style, Line Color, Fill Pattern for the model interpretation layer; the Name for the layer cannot be modified, as the name is defined in the Model Layer Options dialog.
- Click **[OK]** to close the dialog.
- Once this is finished, repeat the same sequence of operations for other model layers within the cross-section domain.

Restrictions on Model Layers

The following restrictions apply when drawing model interpretation layers:

- The model layer line must start at the left boundary and end at the right boundary.
- The line must be drawn from left to right, and may not go backwards (i.e. no

vertices can be drawn left of a previously drawn vertex.)
- Model layer lines cannot intersect each other.
- Model layers need to be drawn in the order they are created. For instance the bottom of model layer 3 can not be drawn between model layers one and two.

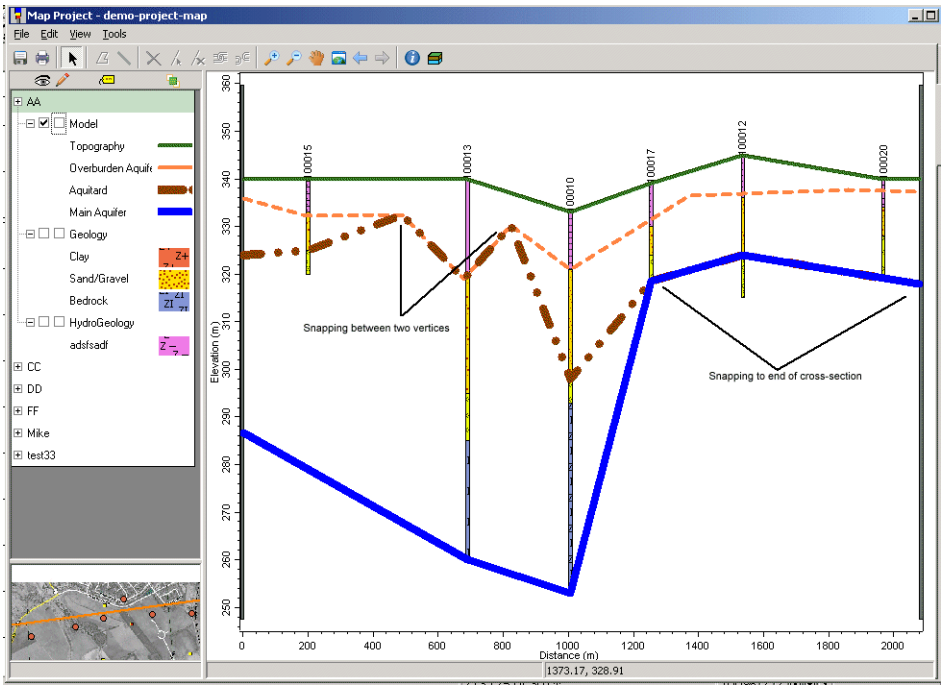
Snapping Vertices to Other Model Layer Lines

While drawing a model layer interpretation line, it is possible to snap to part of, or all of, the vertices of an already drawn model layer line. This can be helpful for defining geologic layers that pinch out (i.e. have zero thickness in some parts of the site).

Snapping between two selected vertices

Whenever a model layer line is drawn, and the vertex of the line is within the buffer for a vertex of an adjacent model layer line, a blue box will appear outlining the vertex on the adjacent line. If the mouse is clicked on this vertex, the vertex will snap to the existing vertex. The line vertex will change to an orange color to indicate the vertex is linked (shared) between the two model layer lines. You can link to as many vertices as desired by repeating the above step.

However, if snapping to a series of consecutive vertices is desired, you may click on the first and the last desired vertices. The cross-section editor will create the necessary number of vertices on the model layer line being drawn and link them to their respective vertices. For instance, if there are five vertices on the existing model line layer between the selected first and last vertices, six vertices will be created on the current model layer line. Linked vertices will move together, and can be separated if needed. The following figure depicts an example of a model layer pinching out around the middle of the cross-section.



Snapping to the end of the cross-section line

If the model layer pinches out from any given point on the cross-section to the end of the cross-section line, the cross-section editor can draw the model line from that given point on for you. To do this, double-click on the first vertex. The model line will automatically be created for you. See the bottom most layer in the figure above.

In this example, the model layer pinches out at the right side of the cross section.

Editing Model Layers

Once the model interpretation layer lines are drawn, it may be necessary to modify the positions of one or more vertices or add more vertices.

To move a vertex,

- Select the (Pointer) tool from the toolbar
- Click once on the desired model layer line to activate
- Click on the vertices to be moved
- Drag the vertex to a new location.

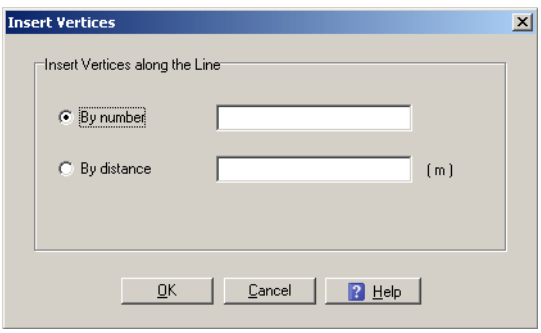
To add a vertex,

- Select the (Pointer) tool from the toolbar
- Click once anywhere on the line to activate the line
- Select the (Add Vertex) tool from the toolbar
- Place the mouse cursor at the desired location on the line; the mouse cursor will change to a pen;
- Click once with the left mouse button at this location to add a vertex

Adding Multiple Vertices

To insert multiple vertices along a model line, follow the steps below:

- From the layer manager panel, enable edit mode for the Model interpretation layers.
- Select a model interpretation line from the cross-section.
- Right-click the line and select **Insert Vertices along Line.** The following dialog will display:



You can insert multiple vertices in one of the following two ways:

- **By number:** inserts a specified number of vertices along the model line, at regularly spaced intervals.
- **By distance:** inserts a vertex at a specified distance interval (e.g every 50 metres), along the entire model line.

Select the desired method, specify a value and click **[Ok]** to insert the vertices.

Other properties of model layers (such as name, pattern and description) can be edited by using the **Tools > Model Layers** menu option described in the “Model Layers” section, on page 338.

Linking Vertices between Model Layers

Once Model Layer lines are drawn, their vertices can be linked following the procedure described in the “Link Vertex” section, on page 325 in the **Edit** menu.

9.4.5 Remove Stations from Cross Sections

When working with a cross-section in the Cross-Section tab, one or more stations can be removed from the cross section line by right-clicking on the cross-section and selecting the **Remove Stations** option. Then simply click on a station to remove it from the cross-section. Stations can also be added to/removed from a cross section line in the Map tab, as described in “Defining a Cross Section Line” section, on page 313.

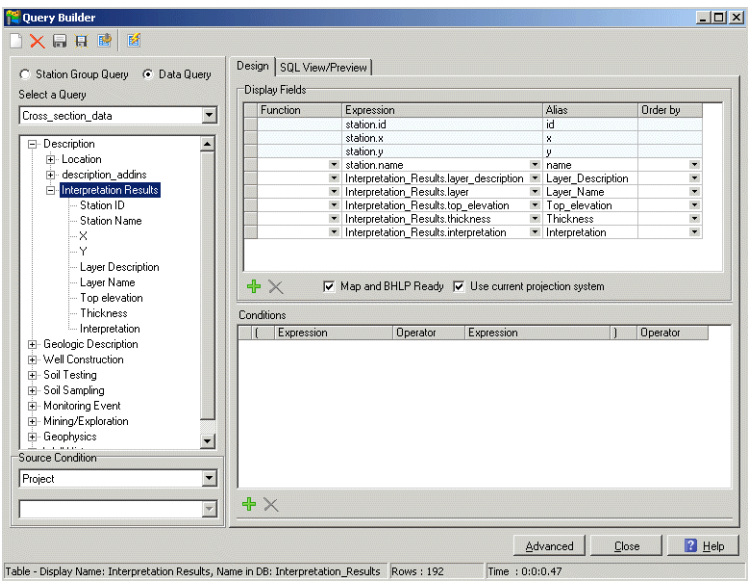
9.5 Querying Cross Section Interpretations

In previous versions of HGA, the cross-section interpretations were saved in shapefiles and along the cross-section line. The cross-section editor now saves the interpretation results to the database, for various uses including:

- displaying the results of each interpretation in HGA
- querying the interpretation table for any desired surface(s) or thickness data, that can be used for groundwater modeling applications

The final interpretation results may be queried for information such as layer thickness at selected station(s), top elevation(s), bottom elevation(s), layer type, name and description.

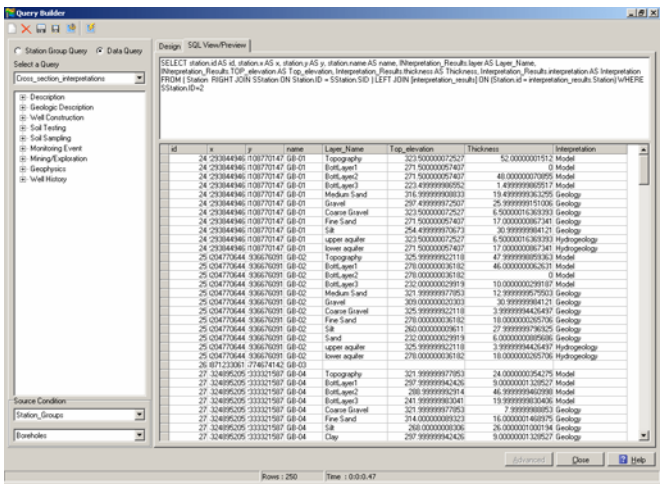
When you create a **Data Query** in the Query Builder, and expand the **Description** data category, you will see the **Interpretation Results** table, as shown below:



The **Interpretation Results** table is read-only, and stores data from the cross-section interpretations. By default, the following fields are included:

- Station ID
- Station Name
- X (using project coordinates)
- Y (using project coordinates)
- Slice Name
- Layer Description
- Top Elevation
- Thickness Below Slice
- Interpretation type

Simply select the desired fields from the tree view, and move these into the **Display Fields**, or **Conditions** as required. When you are finished, Generate and Execute the query. An example of the results is shown in the screenshot below.

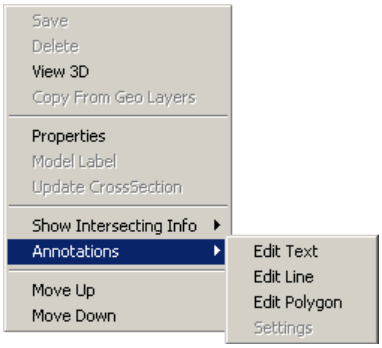


For more details on using the Query Builder, please see Chapter 7: Queries.

9.6 Adding Annotations to the Cross Section

Text labels, lines, and shapes can be added to any layer in the cross-section. To add annotations, you must select the layer, but NOT make it active (i.e. do not check the active (edit) check box). Once the layer has been selected, right-click and select **Annotations** from the list of options. The Edit options shown in the following

screenshot can be used to add, edit, and delete text, lines, and polygons.



To add an annotation, select the appropriate option from the list to enter Edit mode, then click the corresponding button from the toolbar. You can then user your mouse to select the location to add your annotation. After adding an annotation, you will need to click on the corresponding button again to add another annotation of the same type.

> **NOTE:** If you are adding/editing/deleting one annotation type, you must right-click on the selected layer and either switch between annotation types, or de-select the current annotation type, otherwise you will remain in Edit mode for the selected annotation type. Upon deselecting/switching annotation types, you will be prompted to save your changes.

Add Text

To add **text**:

- Select the **Edit Text** option from the pop-up menu.
- Click on the **Text** button on the toolbar
- Click on the desired text location in the cross-section window
- Enter the text in the **Input text** window that appears.

Once a text box has been created, it can be moved by clicking-and-dragging, or edited by double-clicking on the existing text. Text can be deleted by right-clicking on a text box and selecting the **Delete** option. All text added to a layer can be deleted by right-clicking and selecting the **Delete-All** option.

Add Lines

To add **Lines**:

- Select the **Edit Lines** option from the pop-up menu
- Click on the **Draw Line** button on the toolbar
- Click once on the desired line location in the cross-section window, and simply drag and click to create a line with several vertices.

A vertex can be added to an existing line by right-clicking on a line and selecting the

Add vertex option. A line can be deleted by right-clicking on a line and selecting the **Delete** option. All lines added to a layer can be deleted by right-clicking and selecting the **Delete-All** option.

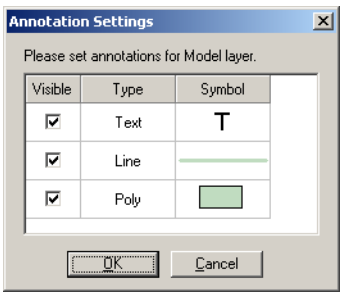
Add Polygons

To add polygons or rectangles,

- Select the **Edit Polygons** option from the pop-up menu
- Click on the **Draw Polygon** or **Rectangle** buttons on the toolbar
- Insert the mouse cursor at the desired location
- Click-and-drag the mouse to create the desired shape (double-click in the case of a polygon to finalize the shape).

Settings

The **Settings** dialog for Annotations is displayed below:



For each Annotation type, you may show/hide using the Visible check box, or edit the display properties by clicking on the preview in the Symbol column. You can modify the standard properties for Text, Line and Polygons, as described earlier in Chapter 8.

To save the annotation changes you have made, you can either deselect/switch annotation types, or click the **Save** button from the button bar.

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HydroGeo Analyst 3D-Explorer

The HydroGeo Analyst 3D-Explorer is an advanced three-dimensional visualization and animation component for displaying and presenting cross sections created with the mapping component included with HydroGeo Analyst. Specifically, this can be used to display multiple cross sections in the form of fence diagrams using a variety of three-dimensional graphical formats. In addition, basemaps may be displayed for relating the fence diagrams to surface features. The graphical tools and presentation formats available are specifically designed for viewing geology and hydrogeology data.

The HydroGeo Analyst 3D-Explorer uses state-of-the-art 3D graphics technology to display your data and sampling results using a complete selection of graphical formats, and features. These include:

- 2D and 3D views of the grid
- Station representation showing lithology
- Imported Surfer Grid surfaces
- Display contaminant plumes in the form of isosurfaces or color maps
- DXF and Bitmap overlays on surfaces
- Light source position control
- Semi-transparent objects
- Auto-rotate tools continuously rotate the image around the X, Y, Z axis
- Record grid rotation to an AVI file.

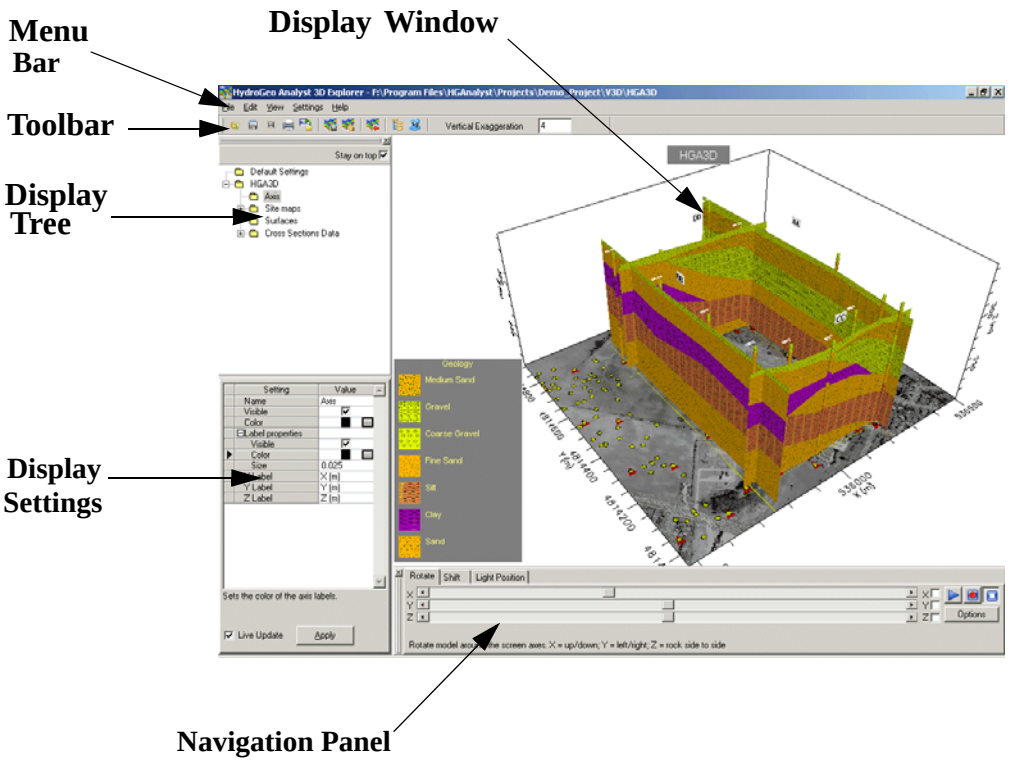
This chapter provides a detailed description of the features and functionality of the various options for preparing and customizing a three-dimensional presentation of your HG Analyst data.

10.1 About the Interface

3D Explorer may be loaded from HydroGeo Analyst in several ways:

- In the Project Tree, select a project from the **3D View** node
- Through the Cross Section Editor, select a cross section and choose the **View 3D** option from the **View** menu.

When the 3D Explorer window is loaded, it should appear similar to the figure shown below.



The 3D Explorer interface consists of the following components:

- **Display Window:** Displays the 3D image of the selected elements.
- **Menu bar:** Provides menu commands for most of the functions.
- **Toolbar:** Provides shortcut buttons for some functions.
- **Display Tree:** A tree-structured list of the available project elements.
- **Display Settings:** Displays settings associated with each element.
- **Navigation Panel:** Contains a set of navigation tools to control the position and orientation of the 3D image, and adjust the light source location.

10.2 Working with 3D Explorer

10.2.1 Positioning the Panels

The **Display Tree Panel** and the **Navigation Panel** are both “dockable” panels, which means they can be moved and/or “docked” to another location on the interface, or they

can be left as “floating” panels on your Windows desktop (i.e. not docked to any location on the interface). These panels can either be docked on the left side of the interface or on the bottom of the interface.

Moving a Panel

To move a panel to another location, position the cursor over the title bar. Press and hold the left mouse button, and drag the panel by moving the cursor to another location; then release the mouse button to “drop” the panel at the new location.

Floating Panels

Once a panel has been moved from the docked position to a floating position, a Title Bar will appear at the top of the panel and it will behave like a separate Window. The **Display Tree Panel** has an option “**Stay on top**”. When this is active, the panel window will float on top of the HG Analyst 3D-Explorer interface as long as it is the active window. When this is active, this panel will always float on top of the HG Analyst 3D-Explorer window.

Docking Panels

Floating panels can be docked again by clicking the mouse pointer on the panel Title Bar and dragging it to the left or bottom edge of the 3D-Explorer window. A grey outline will appear when the mouse pointer is in the proper location and the panel is dockable. Release the mouse button to dock the panel at the desired docking area.

Closing Panels

The panels may be removed from the 3D-Explorer interface by clicking the Close icon **[X]**. The panels can be re-opened using the **View** options from the top menu bar.

The panels can be toggled on/off by clicking the (Hide project browser) button and (Hide Navigation tools) button on the toolbar.

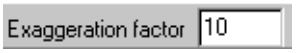
10.2.2 Vertical Exaggeration

In HydroGeo Analyst 3D-Explorer, the vertical exaggeration factor can be changed at any time to obtain a more desirable vertical exaggeration of the project domain. The vertical exaggeration factor is available to provide an improved 3-dimensional view when the scale of the X and Y axis far exceeds that of the Z axis.

When opening 3D-Explorer, the default value of exaggeration factor is set to 1. The Exaggeration factor can be changed in two locations:

- In the Display tree, under the **Project Name** folder; OR
- In the toolbar, top toolbar of the **HG Analyst 3D-Explorer** window as shown

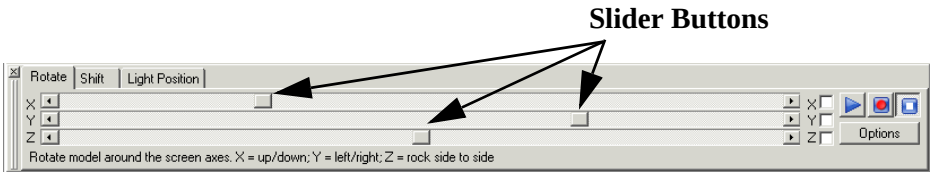
below.



Simply enter a new value in the field, and press the **<Enter>** key on the keyboard.

10.2.3 3D Navigation Tools

The **Navigation Panel** should appear on your screen as shown in the figure below.



If the **Navigation Panel** does not appear on the screen, click **View / Navigation tools** from the top menu bar. Alternately, the **Navigation Panel** can be loaded by clicking the (Hide Navigation Tools) button located on the top toolbar.

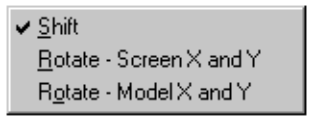
The **Navigation tools** panel contains several tabs:

- The **Rotate** tab controls the rotation of the 3D image around the X, Y and Z axes of the **Display Window**.
- The **Shift** tab controls the location of the 3D image along the X, Y and Z axes of the **Display Window**.
- The **Light Position** tab controls the location of the light source for the 3D image.
- The **Time** tab allows you to adjust the animation time when viewing Plumes
- The **Plume Browser** tab is used when displaying Plumes, and provides a summary view of plume data, using planar slices or isosurfaces

Rotating the Image

The **Slider Buttons** are used to rotate the display window along the selected axis or shift the view within **Display Window**. The X-axis is oriented horizontally left and right across the **Display Window**, Y-axis is oriented vertically up and down the **Display Window**, and the Z-axis is oriented into and out of the **Display Window**.

The image orientation and location can also be changed by *right*-clicking anywhere in the 3D Display window and selecting one of the following options:



- The **Shift** option allows translation of the map region in the plane of the screen by clicking and dragging the mouse pointer in the desired direction.
- The **Rotate - Screen X and Y** rotates the display around the fixed axes of the **Display Window** by clicking and dragging the mouse pointer along the X or Y direction.
- The **Rotate - Model X and Y** rotates the display around the 3D image axes by clicking and dragging the mouse pointer in the desired rotation direction.

Animation Controls

The tools located on the right-hand side of the Navigation frame may be used to continuously rotate the image around the X, Y, and Z axes, and animate plume objects.

Simply select the desired axis and click the **Play button** to start rotation.

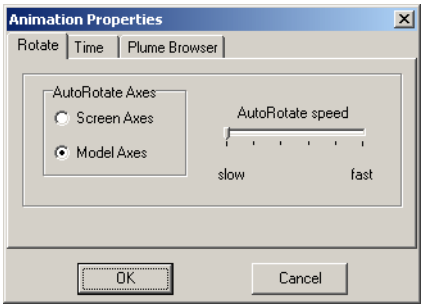
You can record the rotation as an .AVI file by pressing the **Record button**. For more details, see “Recording Animation to AVI file” on page 364 below.

The rotation can be stopped by clicking the **Stop button**.

The **Browser** check box, when selected, will activate the player controls for static animation of the selected color map or Isosurface. For color maps, the map position will span in a loop, along the specified plane, through the project extents. Isosurface values will be animated similarly in a loop, however as the scroll bar moves, the isosurface value will change.

The **Time** check box, when selected, will activate the player controls for time animation. Both color maps and isosurfaces may be animated in time.

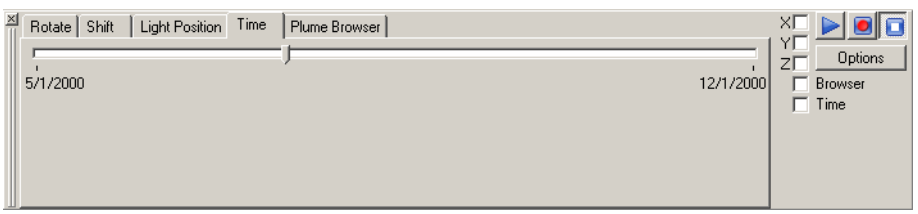
Clicking on the **[Options]** button displays the **Animation Properties** window, as shown in the following figure:



Automatic rotation can be performed around the **Screen Axes** or the **Model Axes**. The **AutoRotate speed** may be adjusted by pressing and holding the left mouse button on the **Slider Button** and setting it to the desired level.

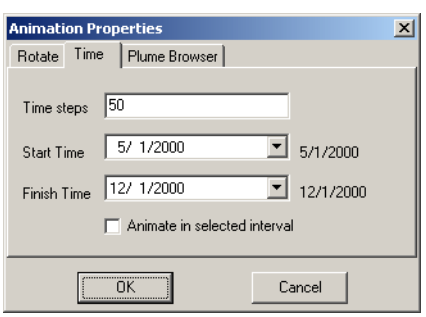
Time Animation

The **Time** tab is available when displaying a transient plume. When the **Time** tab is selected, the following window appears.



Time Animation Options

Clicking the **[Options]** button will load the **Animation Properties, Time** window, as shown below:



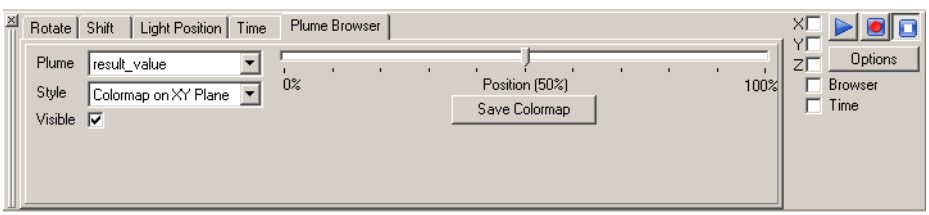
The **Number of time steps for animation** value may be increased to smooth the transition from one time to the next, or it may be decreased to make the animation proceed faster. HGA 3D-Explorer uses interpolation in time, for the case where the time step falls on a date where there is no data. The **Start time** value indicates the simulation time when the animation will begin. The **Finish time** value indicates the simulation time when the animation will end. The **Animate in selected interval** option is used to animate the display element only during the specified start and finish time.

Plume Browser

The **Plume Browser** tab is the location where you can select from pre-defined color maps or isosurfaces, for a preliminary assessment of the plume. As such, there are basic options for color maps and isosurfaces. Once you have a better understanding of where the contaminants lie, and at what time steps, you can use the more advanced options in the **Plumes** node in the tree, including:

- advanced isoline maps with color fill and line settings
- color maps with clip at cut-off options
- display color maps on cross-section lines
- isosurface options, including color from palette, show borders, and display volume estimation

When **Plume Browser** tab is selected, the following options will appear.



When the 3D project was created, 3D-Explorer will display the plume in the form of an isosurface by default. The default isosurface value will be 5% of the maximum concentration value, calculated as a result of the 3D Interpolation.

In the **Plume** combo box, you may select the plume data field used for visualization; you will recall that 3D projects supports multiple plumes (for one or more contaminants).

In the **Style** combo box, select the desired display element. Select from Colormap on XY, XZ, or YZ planes, or Isosurface.

The **Visible** checkbox shows/hides the current plume browser display element.

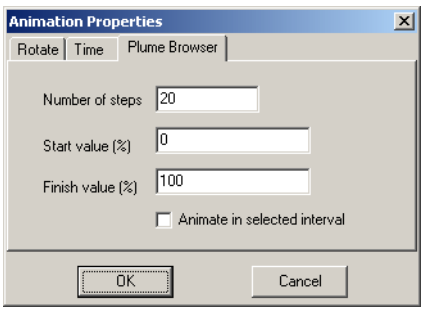
To the right of these controls, you will find a scroll-bar that is used to animate the selected display element. When a color map is selected, the scroll bar **Position** is used

to “slide” the color map along the selected plane, through the project’s site domain (from one side to the other, or in the case of an XY color map, from the top to the bottom). When an Isosurface is selected, the scroll bar is used to span through different isosurface **Values**, or shells. The 0 percent value represents the lowest possible value for the isosurface, based on the interpolated data set, and will result in the largest isosurface. The 100 percent value represents the highest possible value for the isosurface, and will result in the smallest isosurface.

When you are satisfied with a view, click on the **[Save Colormap]** button (or **[Save Isosurface]** in the case of Isosurfaces) to save this display element to the 3D Project, under the **Plumes** node in the tree. By doing so, you will have access to more advanced options for the colormap or isosurface, and this will enable displaying multiple colormaps and/or isosurfaces.

Plume Browser Options

Clicking the **[Options]** button will load the **Plume Browser Options** window, as shown below:

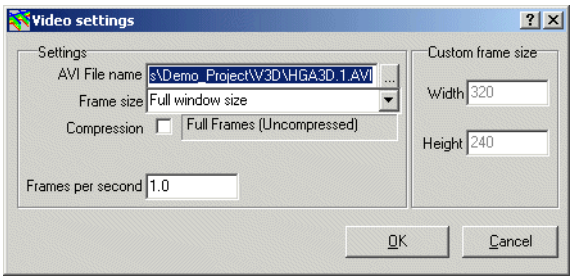


The **Number of steps** value may be increased to smooth the transition from one time to the next, or it may be decreased to make the browsing proceed faster. The **Start value** indicates the value at which the browser will begin (must be a value >= 0). The **Finish value** indicates the value at which the browser will end (must be <= 100). The **Animate in selected interval** option is used to animate the display element only during the specified start and finish values.

Recording Animation to AVI file

HydroGeo Analyst 3D-Explorer supports recording any animation (rotation, plume animation over time, isosurface or color map spanning) to an .AVI file, for playback during presentations and demonstration, using any compatible .AVI file player.

To record the AVI, locate the Record button in the lower right corner of the window. Click on this button, and a **Video settings** window will appear, as shown in the following figure:



The default **AVI File name** is the address of the **V3D** folder for the current project, plus the name of the 3D project and a sequential number of the video made for this project, followed by the .AVI extension.

The **AVI File name** can be modified to any path and filename required by clicking the **[...]** button beside the **AVI File name** field.

The **Frame size** setting has a selection of four options:

- **Full window size**
- **640x480**
- **320x240**
- **Custom**

If the **Custom** option is chosen, the **Custom frame size** fields (**Width** and **Height**) will be activated, and a frame size can be defined.

The **Compression** setting lists the various video compression techniques available. A higher compression setting will reduce the .AVI file size, but it will also reduce the quality of the image.

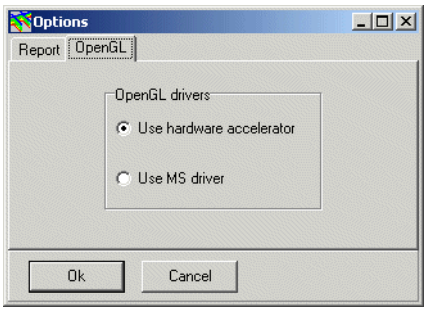
The **Frames per second** setting defines the number of frames (time steps) that will be displayed each second in the AVI file. This setting has no effect on the recording speed.

After specifying the settings, click **[OK]** and the recording will begin.

To stop the recording, click the Stop button.

NOTE: Recording .AVI files will require significant system resources (both RAM and Hard disk space). It is recommended to close all non-essential programs while recording the AVI file, and ensure the destination folder has adequate free space.

10.2.4 OpenGL Settings



By default, the 3D-Explorer will attempt to use the vendor provided driver included with graphics acceleration hardware. If problems are encountered with the vendor provided drivers (display/performance inadequate), then 3D-Explorer provides the option to use the Microsoft Driver for Open GL.

The OpenGL settings can be modified by selecting **Settings / Options** from the main menu bar, then select the **OpenGL** tab.

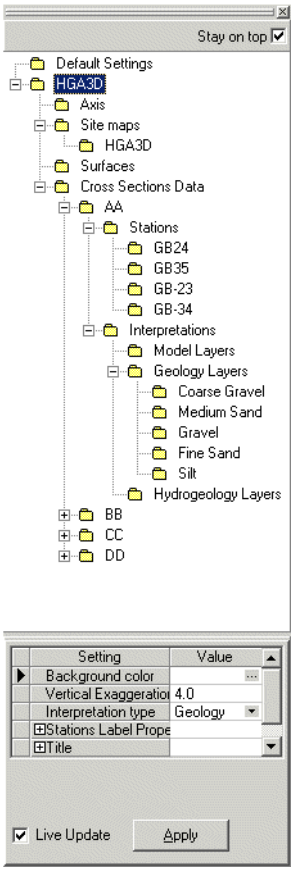
The 3D-Explorer must be closed and re-opened before the new Open GL driver will be used.

10.2.5 Loading Projects

To load a 3D project, select **File / Open** from the main menu, and navigate to a directory where the desired Cross Section is located, or click the (Open) button from the toolbar. Supported files are HG Analyst Cross Section converted files, with the extension *.3XS.

10.3 Display Settings

The **Display Tree Panel** should appear as shown in the figure here. If the panel is not visible, click **View / Model tree** from the main menu bar, or click the button from the toolbar.



The upper section of the **Display Tree Panel** contains a tree structured list of the elements which can be visualized, while the lower section of this panel contains a table of the **Display Settings** for the selected display element. The **Display Tree Panel** can be used to selectively view stations, cross sections, interpretation layers, and legends, or alter the display settings of the selected elements.

The **Display Tree Panel** is structured in a hierarchical fashion where the elements within the tree can be expanded by clicking on the "**+**" symbol.

Each display element listed in the **Display tree** has an associated **"Setting"** list that can be accessed by selecting (clicking) the display element from the tree. A brief description of each display property is available by clicking the mouse pointer on the display property. This produces a tool tip (**Description of the Property**) in the bottom of the **Display Tree Panel** (below the **Setting** table).

Although each display element has a different set of display settings, there are several display settings which are common to most display elements:

- **Name** - Sets the name of the display element as it appears in the **Model tree**
- **Visible** - Shows/hides the selected display element [On/Off]

The following is a brief description of the various display elements and the display settings for each display element listed in the **Display Tree**.

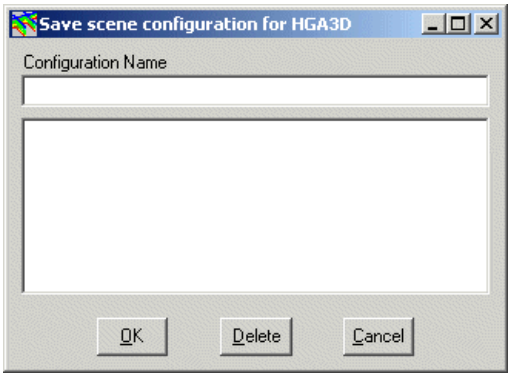
10.3.1 Default Settings

The **Default Settings** are used to define how selected objects are initially displayed when a project is first opened. If **Default Settings** of the selected objects are modified, the new settings may be saved and applied to all HG Analyst 3D-Explorer projects. The Default Settings include:

- Background Color
- Title: Color and Size
- Axis: Text Color and Size, and Line Color

- Legends: Text Color

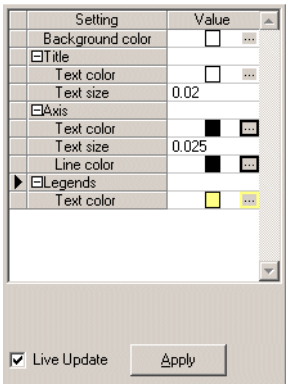
The modified **Default Settings** can be saved by selecting either **File/Save scene configuration** from the main menu bar or clicking the (Save Scene Configuration) button in the toolbar. The following **Save scene configuration** dialog will appear.



Using this window, the most recently viewed scene configuration can be saved by entering a name for it.

When you close 3D-Explorer, the scene configuration you have at that moment will be automatically saved as **Default**. When HG Analyst 3D-Explorer re-opens this project, it is opened with the **Default** scene configuration. Any other user defined configuration can be loaded by pressing the (Load Scene Configuration) button and selecting it from the presented list.

Background color sets the image background color. By default, the **Background color** of the display window is black.



Title

- **Text color** sets the color of the Project title text.
- **Text size** sets the size of the Project title text as a fraction of the total screen size.

Axis

- **Text color** sets the color of the Title text.
- **Text size** sets the size of the Axes labels as a fraction of the total screen size.
- **Line color** sets the color of the axes lines.

NOTE: For printing, it may be helpful to change the background color to white, and the axis color to black.

Legends

- **Text color** sets the color of the Legend text.

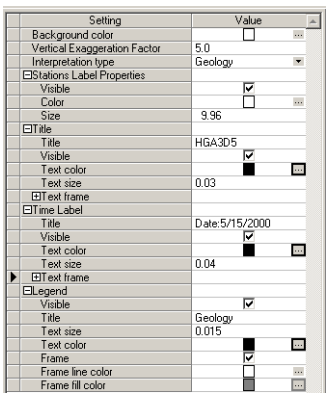
Resetting Options

The currently viewed scene position can be reset to the **Default Setting** by selecting **Edit/Reset scene position** from the top menu bar, or by clicking on the (Reset Scene Configuration) button in the toolbar.

NOTE: The Reset options remove all display objects except the axes, the axes labels, and the project title.

10.3.2 Project Display Settings

The **HG Analyst Project** element consists of general project settings, as shown in the figure below.



By default, the project **Title** is the same as the project name, and it appears at the top of the **Display Window**. This can be moved to any location within the **Display Window** by clicking on the **Title** and dragging it to a new location.

Background color sets the image background color. By default, the **Background color** of the display window is black.

Vertical Exaggeration sets vertical exaggeration factor for the project.

Extend model to plume region: When you load plume files into existing 3D projects, they may lie outside the 3D domain created based on the cross-section extents. Use this option to re-size the 3D domain to include the plume.

Interpretation Type sets the cross-section interpretation type currently in view. Only one interpretation type may be viewed at one time. Choose from Geology, Hydrogeology, or Model. The default is Geology.

Station Label Properties

- **Visible** shows / hides station labels
- **Color** sets color of station labels
- **Size** sets size of the station labels

Title

- **Title** field allows for entering a project title
- **Visible** shows / hides the title
- **Text color** sets the color of the Project title text. The default is white.
- **Text size** sets the size of the Project title text as a fraction of the total screen

size. By default this is 0.02.

- **Text Frame**
  - **Visible** shows / hides the text frame
  - **Line Color** sets the color of the text frame
  - **Fill Color** sets the fill color of the text frame

Time Label: these settings are applicable when displaying time-varying plumes

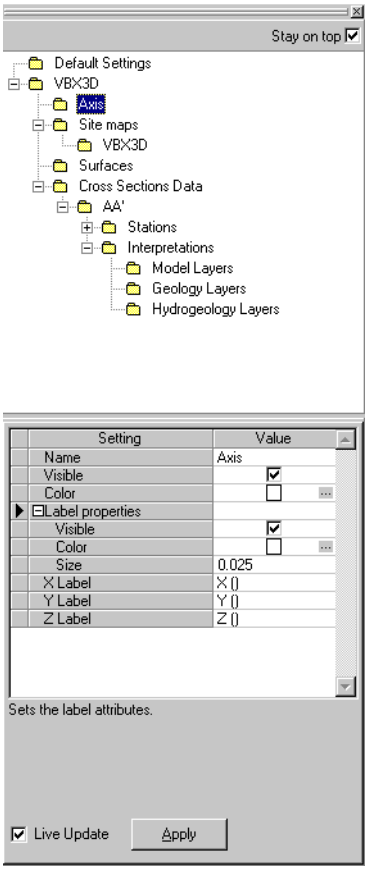
- **Title** field allows for modifying the time label
- **Visible** shows / hides the time label
- **Text color** sets the color of the time label. The default is white.
- **Text size** sets the size of the time label text as a fraction of the total screen size. By default this is 0.02.
- **Text Frame**
  - **Visible** shows / hides the text frame
  - **Line Color** sets the color of the text frame
  - **Fill Color** sets the fill color of the text frame

Legend

- **Visible** shows / hides the legend
- **Title** changes the legend title
- **Text size** changes the legend text size
- **Text color** changes the legend text color
- **Frame** allows to decide whether there is a frame around the legend
- **Frame line color** sets the legend frame line color
- **Frame fill color** sets the legend frame fill color

10.3.3 Axis Display Settings

The **Axis** display element controls the appearance of the lines and labels for the X, Y, and Z axes. The axes are primarily used to indicate the total dimensions (size) of the 3D image and to orient the image when it has been rotated.



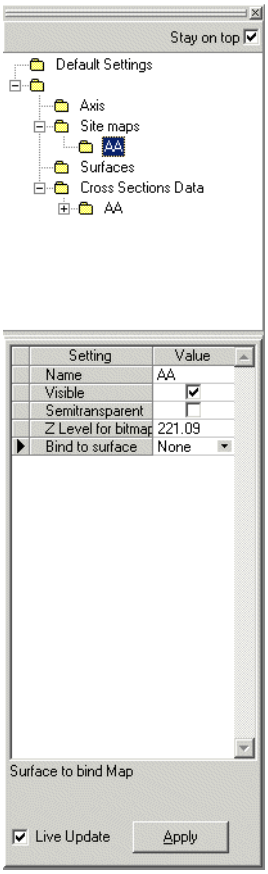
The default axes labels indicate the axes direction and the units, but this can be customized to display alphanumeric text.

A new name may be defined for each of the axes, along with label size and color settings.

10.3.4 Sitemap Display Settings

The 3D-Explorer supports AutoCAD *.DXF files, and *.BMP files for site maps. The **Sitemaps** category contains a list of the sitemaps used in 3D-Explorer, and control the display settings for each individual Sitemap.

To load a site map into the project, select **File / Import Basemap**, from the main menu. In cases where the sitemap is not appearing clearly because of the colors used in the DXF file, you can specify a fixed color to apply to all lines and attributes of the DXF file.

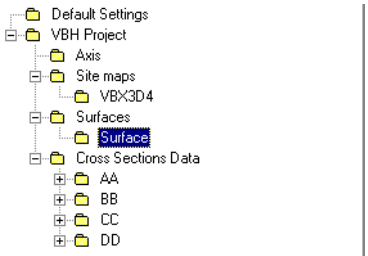


The following settings are available for Site map elements.

- **Name** sets the image name**.**
- **Visible** shows / hides the site map image.
- **Semitransparent** sets the site map image as semi-transparent.
- **Z Level for bitmap** defines an elevation for the site map.
- **Bind to surface** drapes the map over a surface. If there are no surfaces available, the only option will be None. First, load a surface (as explained in the following section), then select a surface for the draped map.

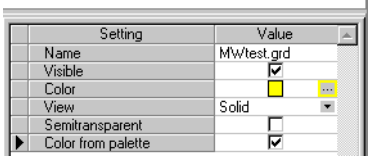
10.3.5 Surfaces Display Settings

The 3D-Explorer supports Surfer Grid (.GRD) files to be used as surfaces in the 3D project. Common surfaces may be a contour map of ground surface elevations, or a water table contour map. Once a surface is loaded, there is an option to drape a site map to the surface, for a truly 3D perspective.



The **Surfaces** category contains a list of the surfaces used in 3D-Explorer, and control the display settings for each individual surface.

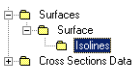
To load a surface into the project, select **File / Import Surface** from the main menu. The following settings are available for surfaces.

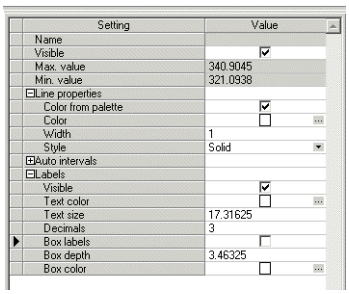


- **Name** sets the surface name**.**
- **Visible** shows / hides the surface.
- **Color** selects a color for the surface.
- **View** selects a style for the surface: choose from wire or solid
- **Semitransparent** sets the surface image as semi-transparent.
- **Color from palette** assigns colors from a palette based on the surface value (e.g. elevation, gw elevation, etc.)

Isolines

For surfaces, you may also display isolines. These settings are displayed below.





You may modify the isoline properties, intervals, and label settings.

Line properties

- **Color from palette** indicates each contour line will be colored according to the contour line value, using the color palette for the selected data type.
- **Color** indicates the solid color used for all contour lines (used only if **Color from palette** is not selected). The browse button can be used to change the current **Color** setting to any RGB color.

- **Width** is the contour line width
- **Style** indicates the line style used to plot each contour line (choose from Solid, Dashed, and Dotted).

Auto Intervals

- **View** shows/hides the automatic lines
- **Upper Limit** is the maximum data value, above which no contour lines will be plotted
- **Lower limit** is the minimum contour line, below which no contour line will be plotted
- **Interval** is the increment value at which contour lines will be plotted, starting from the **Lower limit** value

Labels

The **Labels** setting is used customize the appearance of the contour labels.

- **Visible** shows or hides the labels
- **Text color** controls the color of the label
- **Text size** controls the size of the labels
- **Decimals** is the number of decimals used for each label value
- **Multiple Labels** enables showing multiple labels on the line
- **Distance** sets the distance value between each label; smaller distance values will result in more labels
- **Box Labels allows drawing a box around each label**

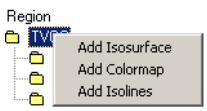
10.3.6 Plumes Display Settings

HGA 3D Explorer is capable of displaying and animating 3D Isosurfaces (volumetric plumes) of soil or groundwater chemistry data. The 3D Plume must be generated from a data query in the main HGA window before displaying it in 3D Explorer. For details on how to generate the plume, please see Chapter 3: 3D Interpolation.

The plume can be added to the 3D Project when working in the cross-section editor; for more details, see Chapter 9: View 3D.

You may also import a plume into an existing 3D project; to do so, select **File / Import Plume** from the main menu.

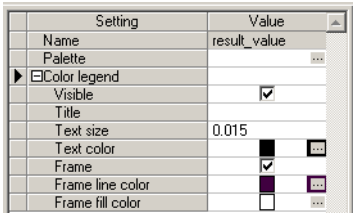
The plume may be visualized with one of the display formats shown below, when you *right*-mouse click on any data plume in the model tree.



- **Add isosurface** (see “Isosurfaces” on page 375 for more details)
- **Add color map** (see “Color Maps” on page 377 for more details)
- **Add isolines** (see “Isoline Maps” on page 379 for more details)

Refer to the respective sections for instructions on how to create these display elements, and for details on the display settings associated with each one.

The display settings shown below controls the global settings for all **Plume** display elements.



The **Name** option controls the display name for the plume in the tree view.

The **Palette** option controls the color scale used on all **Plume** display elements. A description of the **Palette** options is available below; see “The Color Palette” on page 382.

The **Color legend** settings are used to modify the appearance of the color legend as it applies to all color map display elements. A description of the **Color legend** options is available below; see “The Color Legend” on page 384.

Isosurfaces

An isosurface is a 3D planar surface defined by a constant parameter value in 3D space. Isosurfaces are typically used for demonstrating the spatial distribution of a selected parameter. For groundwater modeling purposes, isosurfaces are generally used for representing the spatial distribution of concentrations.

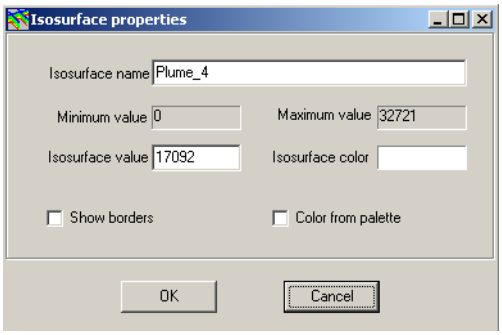
HGA 3D-Explorer allows you to create and simultaneously display multiple isosurfaces for the one or more plumes in your project.

Creating Isosurfaces

To create an isosurface, click on the desired plume data set in the **Model tree** to highlight it, then *right*-click on the element and select **Add Isosurface** from the pop-up menu;

Alternately, isosurfaces may be created by highlighting the desired element and clicking the **[Create isosurface]** icon located above the **Model tree**.

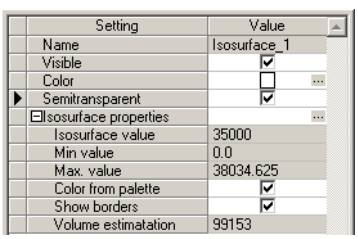
This will open the **Isosurface properties** window, as shown in the following figure:



This window is used to set the display settings of the isosurface as described below:

- **Isosurface name** defines the name of the isosurface as it will appear in the Model Tree under the selected element
- **Minimum value** is the calculated minimum value from the interpolated data set
- **Maximum value** is the calculated maximum value from the interpolated data set
- **Isosurface value** is the element value for which the isosurface will be created
- **Isosurface color** is the user-specified color of the isosurface (double-click the **color** box to customize the color)
- **Show borders** will display a color map of the element values on the borders (sides) of the model domain when the isosurface intersects the edge of the model domain
- **Color from palette** will use the element color palette to automatically color the isosurface according to the specified isosurface value

Once the isosurface is created, the display settings can be accessed from the tree view. These are shown below:



Visible check box shows/hides the isosurface.

Semitransparent check box sets the isosurface image as semi-transparent

The **Volume Estimation** value represents the calculated volume that the isosurface encompasses; for lower isosurface values will result in higher Volume Estimations; higher isosurface values will result in lower Volumes. The volume estimation works in

the following manner:

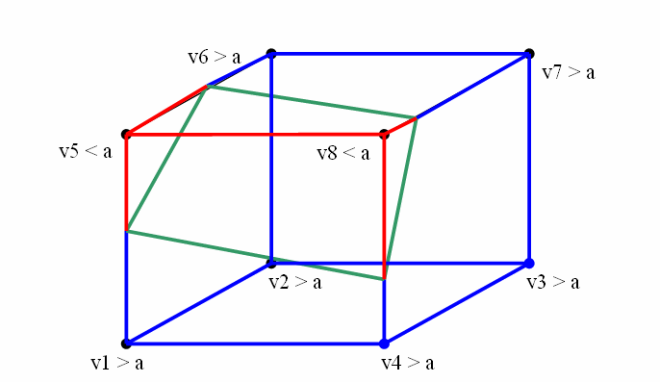
When you ran the 3D Interpolation to create the plume data set, you specify the grid size (# grid cells in the X, Y and Z direction). The volume estimation uses the number of grid cells, and the X,Y, and Z extents to calculate the size of each grid cell. The interpolated concentration value is calculated for each node of the grid cell. A grid cell in the plume grid has eight nodes with associated values (v1, v2, v3…). There are three possibilities:

1) all values at the nodes are less than the isosurface value (a). In this case, the cell volume is not added to plume volume estimation;

2) all values at the nodes are greater than the isosurface value (a). In this case, the entire cell volume is added to plume volume estimation;

3) some values are greater than the isosurface value (a), and some are less. In this case the isosurface crosses the cell (green polygon on picture), and the linearly-interpolated portion of cell volume is added to plume volume estimation (only a part of the cell volume is added to the plume estimation).

The volume estimation value will be in the length units for the X, Y co-ordinates specified in the database. For example, if you use UTM, and X and Y are entered in meters, then the volume estimation value will be in cubic meters.



Color Maps

The **Color maps** elements allows you to create a color-shaded map for the concentration data, that will plot distributed colors, A color legend for the **Color map** will also appear in the top left-hand corner of the **Display Screen**.

Creating a Color Map

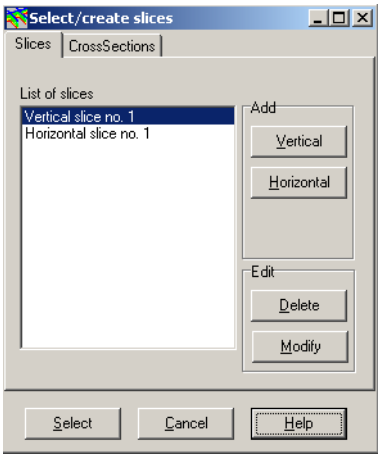
To create a color map, click-on the desired element in the **Model tree** to highlight it,

then *right*-click on the element and select the **Add color map** option from the pop-up menu.

Alternately, color maps may be created by highlighting the desired element and clicking the **[Create color map]** icon located above the **Model tree**.

This will open the **Select/create slices** window (shown below) with a list of the available surfaces (slices). The color map can be plotted on any of the surfaces listed, or on cross-section lines.

If there are no slices in the list, then this window can be used to create the desired vertical or horizontal slices to use for plotting Color maps and Contour maps. For more details, see “Creating Slices and Cross Sections” on page 386 below.

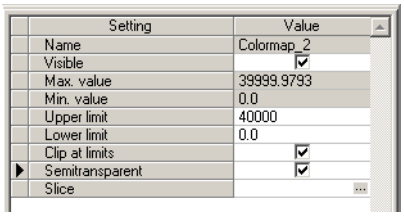


To select a surface from the list, click on the desired surface and then click the **[Select]** button.

A color map of the plume will then appear on the selected surface, and a **Color map** element will be added to the **Model tree** under the **Plumes** node.

Color Map Display Settings

Once the Color map element has been added to the Model Tree, the display settings can be customized as described below:



- **Name** is the name for the color map
- **Visible** shows or hides the color map
- **Max. value** is the calculated maximum value for the plume
- **Min. value** is the calculated minimum value for the plume
- **Upper limit** is the data value above which the color map may be clipped out (not displayed).
- **Lower limit** is the data value below which the color map may be clipped out (not displayed).
- **Clip at limits** indicates whether the color map will clipped above the **Upper limit** and below the **Lower limit**.
- **Semitransparent** sets the color map as semi-transparent
- **Slice** field contains a link to the Slice options; see “Creating Slices and Cross Sections” on page 386 below for more details.

Isoline Maps

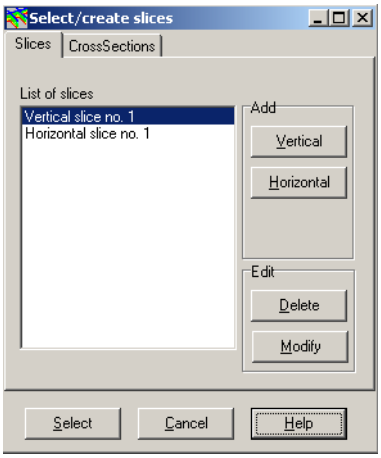
Isoline (Contour) maps are a set of lines plotted on a surface, whereby each line is connected by a set of points having equal values of a given data type.

Creating Isoline Maps

To create a **Isoline map**, click-on the desired element in the **Model tree**, and then *right*-click on the element and select the **Add Isolines map** option from the pop-up menu.

Alternately, contour lines may be created by highlighting the desired element and clicking the **[Create contour map]** icon located above the **Model tree**.

This will open the **Select/create slices** window with a list of the available surfaces (slices). The contour map for the selected model element can be plotted on any of the surfaces listed, or on cross-section lines.



If there are no slices in the list, then this window can be used to create the desired vertical or horizontal slices to use for plotting Color maps and Contour maps. For more details, see “Creating Slices and Cross Sections” on page 386 below.

To select a surface from the list, click on the desired surface and then click the **[Select]** button.

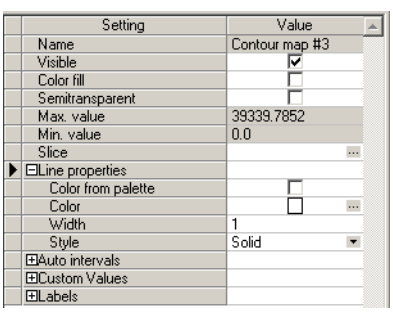
A contour map of the plume will then appear on the selected surface, and a **Contour map** element will be added to the **Model tree** under the **Plumes** node.

Isoline Map Display Settings

Once the **Isoline map** element has been added to the **Model Tree**, the display settings can be customized as described below.

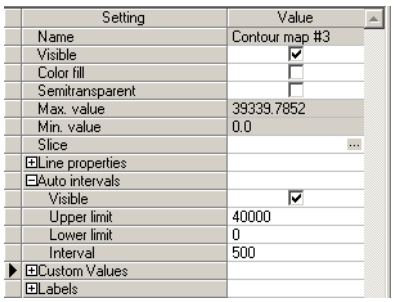
Color fill will fill the space between contour lines with a solid color, where the color between lines is scaled according to the lower contour line value

Line properties



- **Color from palette** indicates each contour line will be colored according to the contour line value, using the color palette for the selected data type.
- **Color** indicates the solid color used for all contour lines (used only if **Color from palette** is not selected). The browse button can be used to change the current **Color** setting to any RGB color.
- **Width** is the contour line width
- **Style** indicates the line style used to plot each contour line (choose from Solid, Dashed, and Dotted).

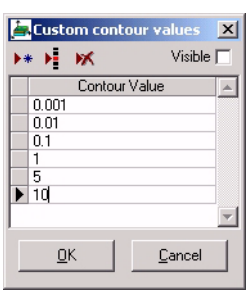
Auto Intervals



- **Upper Limit** is the maximum data value, above which no contour lines will be plotted
- **Lower limit** is the minimum contour line, below which no contour line will be plotted
- **Interval** is the increment value at which contour lines will be plotted, starting from the **Lower limit** value

Custom values

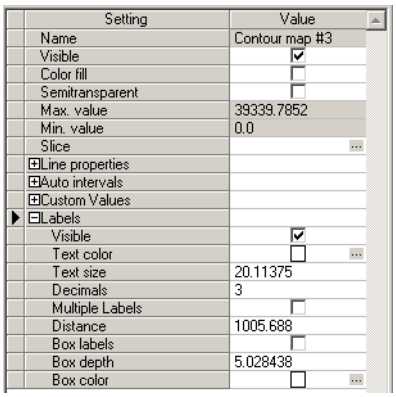
The **Custom Values** setting is used to assign custom contour values in addition to, or in replacement of, the regular interval contour values. Press the browse button **[...]** to load the **Custom contour values** window, as shown in the figure below



- Click to add a value
- Click to insert a value
- Click to delete a value

This setting is commonly used to set logarithmic contour interval values for concentration data.

Labels



The **Labels** setting is used customize the appearance of the contour labels.

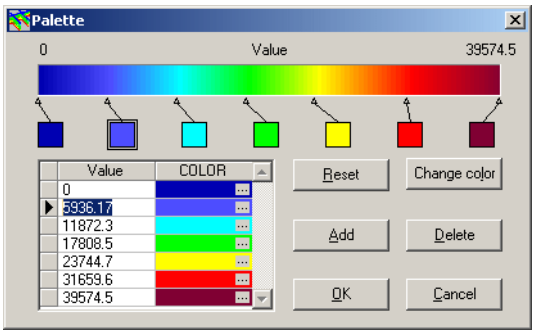
- **Visible** shows or hides the labels
- **Text color** controls the color of the label
- **Text size** controls the size of the labels
- **Decimals** is the number of decimals used for each label value
- **Multiple Labels** enables showing multiple labels on the line
- **Distance** sets the distance value between each label; smaller distance values will result in more labels
- **Box Labels** allows drawing a box around each label

The labels are plotted on the top and bottom surface of a flat 3D rectangular box. The size of the box will be automatically adjusted to fit the text size, but the **Box color** and **Box depth** can be customized.

The Color Palette

The color **Palette** is used to customize the range of colors used to represent the values of selected model elements for each display object; this includes the color maps, isolines, and isosurfaces. The color **Palette** settings will govern the color scaling used on each display object. The color **Palette** settings can be modified by selecting one of

the display elements, and clicking the **[...]** button in the **Palette** field of the **Display Settings** table. The **Palette** window will appear as shown in the figure below.



The default color setting contains a gradation of seven colors, ranging from a dark blue at the minimum value, to a dark red at the maximum value. This range of colors, and the values associated with each, will be reflected in the **Color Legend** for the selected display element.

Changing Color Values

The parameter values associated with each color can be changed by typing in a new value, or by clicking on one of the color boxes beneath the color bar, and dragging the arrow to a new location on the color bar.

Changing Colors

The color for each color box can be modified by selecting the color box and then clicking the **[Change color]** button, or by clicking the **[...]** button for the color you would like to change. Each color can be selected from an RGB 16 million color palette.

Adding Color Intervals

In order to display more than seven color increments, additional colors can be added to the color scale by clicking on one of the colors in the color value table, and then clicking the **[Add]** button. A new color entry will be added with a value midway between the previous and next value.

Deleting a color

To remove a color increment, simply select the color from the **Color Value** table, and click on the **[Delete]** button.

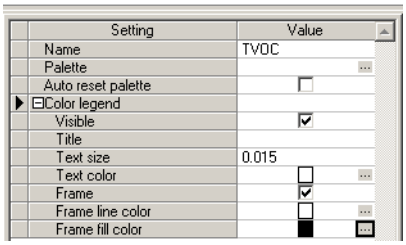
Resetting the Color Palette

The color settings can be reset to the initial default values by clicking the **[Reset]** button.

The Color Legend

The **Color Legend** is a scale of the element values associated with each color. The values and colors shown in the **Color Legend** are defined by the **Color Palette** settings for the selected data type element (see previous section).

Other display settings, including **Title**, **Text size**, **Text color**, and **Frame color**, can be customized using the display settings options, shown in the figure below.



The color legend will automatically appear in the top left-hand corner of the **Display Screen** whenever a display object using the color palette is plotted (e.g. color map). It can be moved to any other location in the **Display Screen** by dragging-and-dropping it at the desired location

10.3.7 Cross-Section Data Display Settings

The **Cross Section Data** tree contains the properties of the cross sections loaded in the project:

- **Stations**
- **Interpretations**

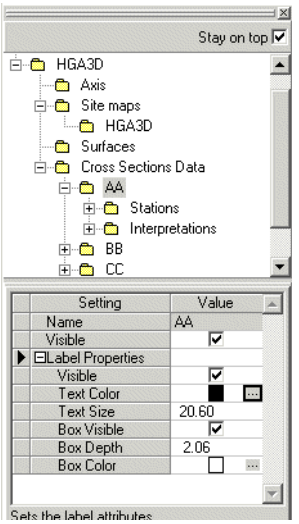
Each of these display elements contains further settings as described below.

Cross Section Settings

The **Cross Section** contains the name as defined in the Cross Section Editor.The entire cross section may be set to **Visible,** or hidden from view.

The **Label Properties** allow you to modify the following settings:

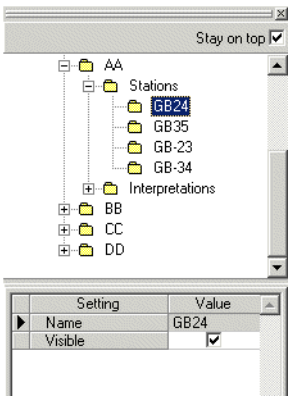
- **Visible** turns cross section labels on / off
- **Text Color** changes text color
- **Text Size** changes text size
- **Box Visible** turns the outline box on / off
- **Box Depth** changes the “thickness” of the label
- **Box Color** changes the label background color



Stations Display Settings

Under the **Stations** node there will be a list of the HydroGeo Analyst stations which are involved in the selected cross section. Individual stations may be selected, and set to **Visible,** or hidden.

Station label properties can be modified in the **Station Label Properties** options under the Project node.



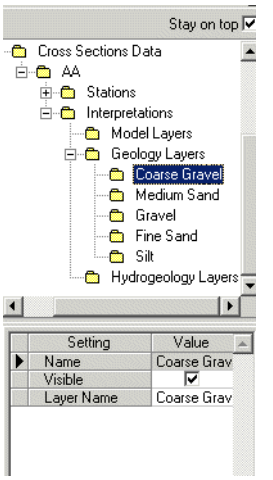
Layer Interpretation Settings

Under the **Interpretations** folder, there will be three separate sub-folders, one for each of the interpretation types:

- **Model**
- **Geology**
- **Hydrogeology**

Under each individual Interpretation Layer, there is a list of the soil types belonging to this layer. Each soil type has its own settings as shown here.

The soil **Name** may not be modified; this name will appear in the Legend contents. Each individual soil type may be set to **Visible** or hidden from view.



10.4 Creating Slices and Cross Sections

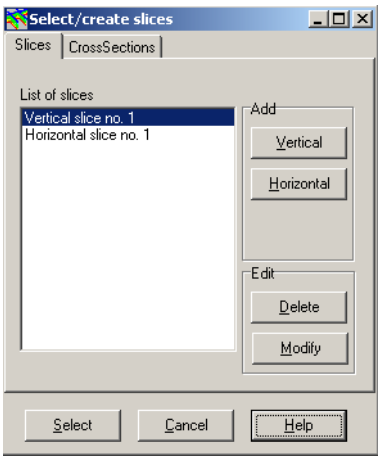
A slice is defined as a 3D planar surface extending horizontally or vertically through the project. There are three types of slice objects available:

- **Vertical slices** along the XZ or YZ plane, extending through the entire depth of the domain
- **Horizontal slices** along the XY plane of the project domain
- **Cross-section slices** along a straight line, or an irregular polyline, through the entire depth of the domain; these are based on cross-sections available in the 3D project

These slice objects define the locations where color maps and contour maps can be plotted for concentration visualization.

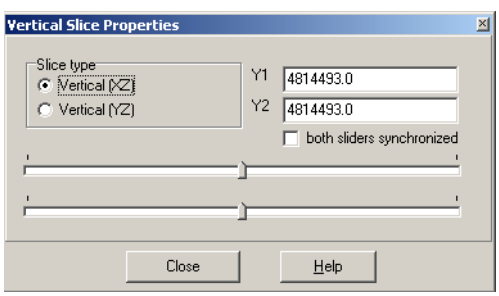
To define the slice locations, select **Objects/Surfaces** from the top menu bar. A **Select/create slices** window will appear, as shown in the following figure.

The **Select/create slices** window displays a list of the available slices which have been previously defined. The **Select/create slices** window also has options to create additional slices, or to modify/delete existing slices.



10.4.1 Creating a Vertical Slice

To create a vertical slice through the project domain, click the **[Vertical]** button to open the **Slice Properties** window as shown in the following figure. A yellow outline of the vertical slice will appear in the **Display Screen**.



The **Slice type** options define the planar orientation of the slice:

- **Vertical XZ** refers to the plane along the X-axis extending through the entire depth of the site
- **Vertical YZ** refers to the plane along the Y-axis extending through the entire depth of the site

For a **Vertical XZ** slice, the **Slider Bar** moves the vertical slice along the Y-axis, and the Y-axis values are displayed in the fields labelled **Y1** and **Y2**. Alternately, a Y-axis value can be typed directly into this field.

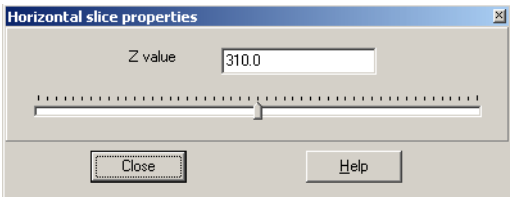
For a **Vertical YZ** slice, the **Slider Bar** moves the vertical slice along the X-axis, and the X-axis value is displayed in the field labelled **X1** and **X2**. Alternately, an X-axis value can be typed directly into this field.

When the desired location for the vertical slice has been defined, click the **[Close]** button to save the vertical slice type and location.

The new vertical slice will appear in the **Surfaces** window.

10.4.2 Creating a Horizontal Slice

To create a horizontal slice through the domain, click the **[Horizontal]** button to open a **Horizontal slice properties** window as shown below. A yellow outline of the horizontal slice will appear in the **Display Screen**.



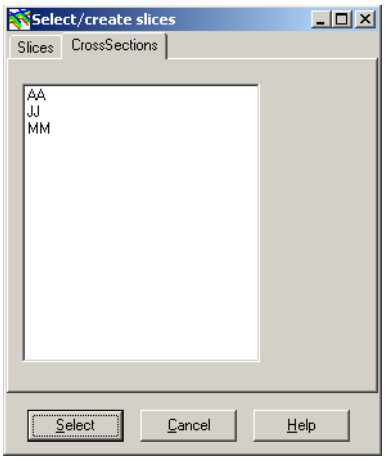
The **Slider Bar** moves the horizontal slice along the vertical Z-axis, and the corresponding slice elevation is displayed in the field labelled **"Z value".**

When the desired location for the horizontal slice has been selected, click the **[Close]** button to save the slice type and location.

The new horizontal slice will appear in the **Surfaces** window.

10.4.3 Selecting a Cross Sectional Slice

When adding a color map or isoline map, you may also utilize cross-section lines that were defined in the Map Manager, provided they have been added to the current 3D project. To select a vertical cross-section through the site domain, click the **[Cross-section]** tab to open the **Cross-section** window as shown in the following figure. This window displays a list of the available cross sections for the current 3D project.



Simply select the cross-section from the list, then click the **[Select]** button.

10.4.4 Deleting a Slice

If many different slices have been defined during the current session, and the list is becoming too long and cumbersome to work with, any entry in the **Surface list** can be deleted by highlighting the slice in the list and clicking the **[Delete]** button.

10.4.5 Modifying a Slice

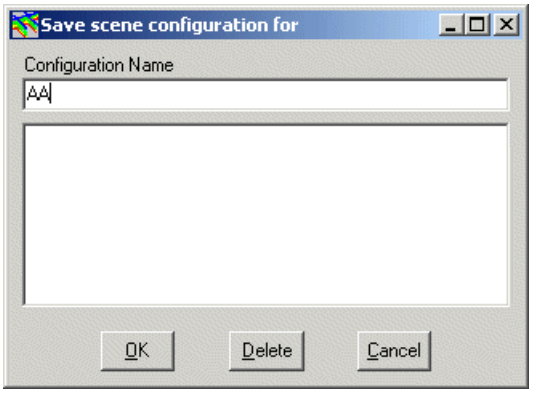
The location or orientation of any slice can be modified by highlighting the target slice in the list and clicking the **[Modify]** button. This will open the **Slice Properties** window, where the desired changes can be made

10.5 Scene Configurations

When using 3D-Explorer to display and animate data, it is important to be able to save the various display settings for fast and easy recall during a presentation, or for comparing different views.

3D-Explorer is able to save the display settings by selecting **File / Save Scene configuration** from the top menu bar or by clicking the (Save Scene configuration) button in the toolbar.

This will load the **Save Scene Configuration** dialog.

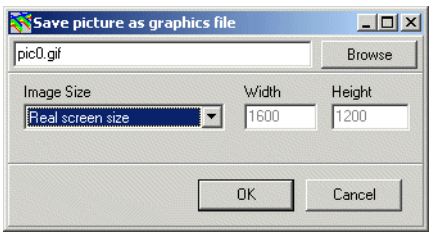


Type the desired name of the scene in the **Configuration Name** field and click **[OK]**.

This scene configuration (including attributes, rotations and shifts) can be loaded during a later session by selecting **File / Load scene configuration** from the main menu bar, or by clicking the (Load scene configuration) button in the toolbar.

10.6 Saving and Exporting Options

The displayed image can be saved by selecting **File / Export Diagram** from the top menu bar, or by clicking the (Export Image) button in the toolbar. The following **Save picture as graphics file** window will appear.



In the **Image Size** field, opening the combo box shows a list of several different sizes for the image size to be saved. The desired size of the image may be selected or customized by entering new **Width** and **Height** values. The image can be saved to three graphics formats:

- **GIF**
- **Bitmaps (.bmp)**
- **JPEG Image File (.jpg)**

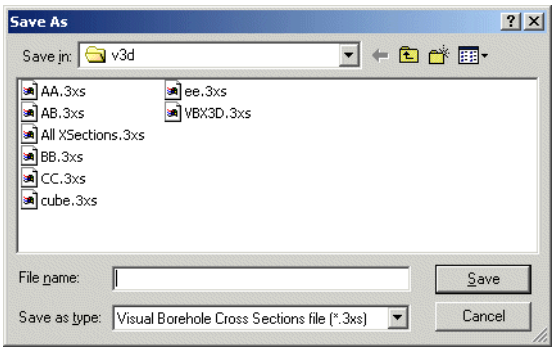
Any of these graphics formats can be imported into most word processing software packages.

Alternately, the image may be copied to the Windows clipboard by selecting **Edit / Copy** from the menu. This image can be pasted into most word processing and graphics editing programs.

> **NOTE**: The resolution of the graphics file image will depend on your screen resolution and on the size of the **Display Window**. In order to maximize the image quality you should maximize the **Display Window** to full screen.

10.6.1 Saving Project

The 3D project can be saved to file by selecting **File/Save As...** from the Main Menu, or click the (Save As) icon from the toolbar. The following **Save to file** dialog will appear.



The 3D image is saved with the extension, *.3XS, and will be saved in the **\HGAnalyst\Projects\Project_Name\V3D** folder, by default.

Save an existing project by selecting File/Save from the Main Menu, or by clicking (Save) icon from the toolbar.

10.7 Printing the 3D Image

To print the desired 3D view select **File/Print,** or click the (Print) button from the toolbar. This will load the Report Manager, where the 3D image may be placed into a Report template, or printed as is.

For more details on modifying images in reports, please see Chapter 11: The Report Editor.

11

The Report Editor

The WHI Report Editor included with the HydroGeo Analyst package is used to create professional reports containing data, and 2D and 3D-views you have generated for your projects. This chapter presents information on how to transfer stations, grids, query results, maps, cross-sections, borehole log plots, and 3D views into a printable report format, which can be printed or exported for convenient transfer to your colleagues and/or clients.

The Report Editor provides the following features:

- Create and save Report Layout Templates
- Create and Manage Reports
- Import Reports
- Design and Preview Reports
- Save, Export, and Print Reports

In addition the report editor:

- Provides an easy-to-use Office-like designer environment
- Supports VBScript and JScript events and expressions
- Provides Barcode control
- Allows report bookmarks and internet hyperlinks

NOTE: This chapter provides a brief overview of the features that the Report Editor offers. For more details, refer to the Active Reports on-line help file. This file is named AR2Std.CHM, and is found in the report folder of the HG Analyst installation folder; (The default is **\Program Files\Common Files\Data Dynamics\Active Reports\AR2Std.chm**). Simply double-click on the .CHM file to load the help file.

11.1 About the Interface

The Report Editor may be launched from HydroGeo Analyst in several ways:

- Select **Project / Report** or click on the (Report) button in most HydroGeo Analyst modular windows (Map Editor, Cross Section editor, 3D Explorer, or the main window). When this option is selected, if there are report templates

available for this module, there will be a prompt to Select a Report Template, before proceeding.

- The Report Editor may be loaded from the Project Browser in the main window; simply double-click on an existing Report or Report template under the **Reports** node

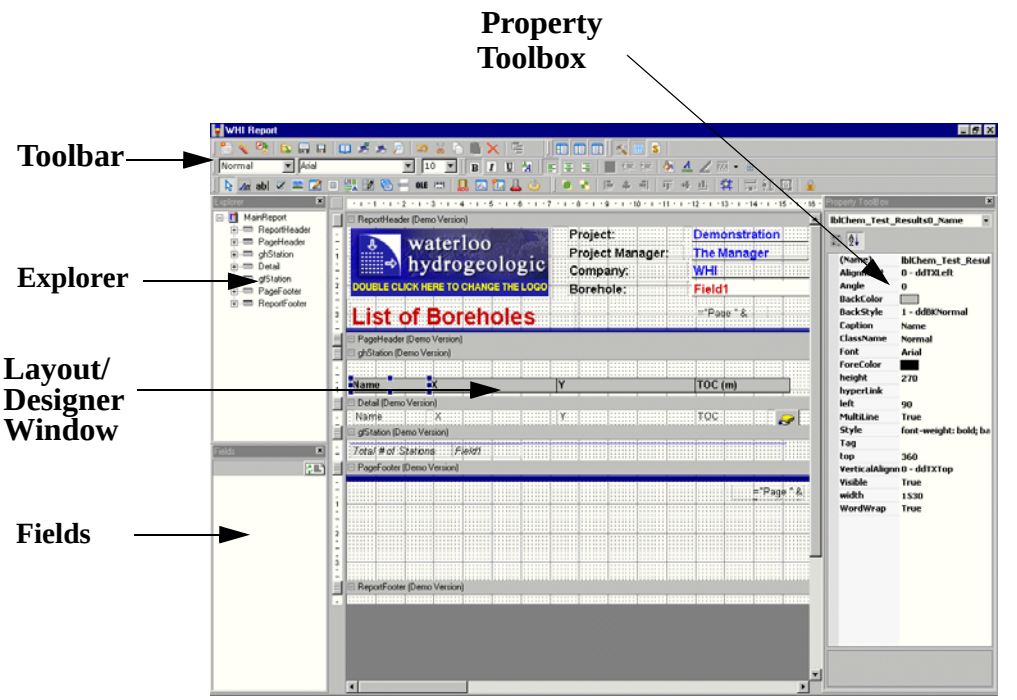
The report editor consists of two main windows:

- The Runtime Designer (Designer) and
- The Viewer

Each component of the Report Editor comes with its own set of toolbars and icons that perform specific tasks related to the window. The following few sections present a detailed description of the toolbar icons for each component.

11.2 Report Designer Window

The Report Designer allows you to design the contents, as well as looks, of your reports. All report designs can be saved and opened for editing and/or generating the final report. A sample of the designer view is shown below (with a report template loaded for demonstration purposes).



The designer window contains the following items:

- **Property Toolbox:** provides the tools that can be used to edit properties of the report and all its sections including any controls that the report may contain.
- **Toolbar:** provides multiple buttons for functions in the designer
- **Explorer:** allows you to browse through the controls that are placed on the currently opened report. It facilitates selecting a control for further editing.
- **Layout window:** provides the interface for designing the report
- **Fields:** allows you to select one or more data fields, for displaying data. Simply drag and drop the selected field into the desired section of the report.

11.2.1 Report Designer Toolbars

The figure below shows a closer view of the toolbars used in the Report Designer window:

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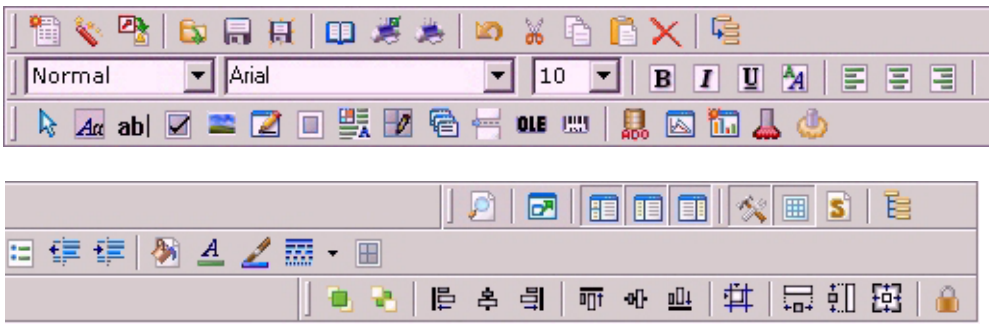


The following sections describe the toolbar buttons of the designer window.

Main Toolbar

New Report: Allows you to create a new report;

Report Wizard: Allows you to create a new report using the report wizard

Import MS Access Reports: Allows you to import reports that are created in MS Access

Open Report: Allows you to open an existing report

Save Report: Allows you to save the active report

Save Report As: Allows you to save the active report with another name and/or format (i.e. as a report template, if desired)

Page Setup: Allows you to edit the page setup properties

Printer Setup: Allows you to configure printer settings

Print Report: Allows you to generate the report and send it to a printer

Preview Report: Previews the report before printing

Undo: Cancels the last operation

Cut: Cut selected text or object from the report designer

Copy: Copies selection to clipboard

Paste: Pastes contents of the clipboard to the report designer

Delete: Deletes current selection

Reorder Groups: Displays the groups order dialog

Display Settings Tools

Report Explorer: Displays/hides the control that displays all report elements placed on each section of the report;

Fields: Displays/hides the control that displays a list of fields available for the report

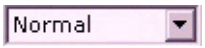
Properties: Displays/hides the properties control for the report

Toolbox: Displays/hides the toolbar hosting the toolbox icons

Grid: Displays/hides grid lines on the Designer

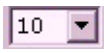
Script Editor: Launches the VBScript editor that may be used to enhance report automation

Formatting Tools



Text Style: Selects a format style

Font: Selects a font for the selected object



Font Size: Sets the font size for the selected object

Bold: Sets the bold status of the selected text

Italics: Sets the italics status of the selected text

Underline: Sets the underline status for the selected text

Detailed Font: Launches a dialog that allows setting font details

Left Align: Aligns selected text on the left margin

Center Align: Centers selected text

Right Align: Aligns selected text on the right margin

Bulleted List: Formats the selected paragraph in the RTF control as a bulleted list

Outdent: Outdents the selected paragraph in the RTF control as a bulleted list

Indent: Indents the selected paragraph in the RTF control as a bulleted list

Background color: Sets the background color of the selected control

Text Color: Sets the forecolor of the selected text

Line Color: Sets the line color of the selected control

Line style: Sets the line style of the selected control

Border: Sets the border style of the selected control

General Tools

To insert any of the items listed below into your report, select the item from the toolbar, and in the designer window, draw a box in the position where you wish that object to appear.

Select: Selects a control (object) on the Designer

Label: Allows you to put headings and labels in your report

Field: Insert it and link to a data field to display specific data from the project. **Field** also allows you to put text in your report

Check box: Add a check boxes to a report; can be used to create check lists in your report

Image: Add logos, maps, and other images to your report. You can link it to a data field in your project, or to an image file outside of the project

Line: Add simple lines in your report

Shape: Add shapes (rectangle, square, circle,...) to the report

Rich Text Control: Add a text box with a RTF text to your report

Frame: Add a frame in and/or around the report. Similar to the square Shape tool, however the emphasis is on the border, not fill.

Subreports: Add any number of subreports to the report. The subreport will be limited by the width of the control, but the height will grow to accommodate the length of the subreport.

Page Break: Add a page break in the report at a desired location

OLE Object: Add an OLE (Object Linking and Embedding) object (such as a picture) to the report

Bar Code: Insert a bar code into the report

ADO Control: Click on it to add a ADO (ActiveX Data Object) datasource control on the report

Chart Object: Drag it to the designer to add a chart to the report

Charts Manager: Set the properties of the selected chart

Well Profile: Add a borehole log plot to the report

ActiveX Controls: Add any ActiveX control that is registered on the current computer to your report

For more information on the available options, see “Toolbox options for General Tools” on page 401.

Alignment Tools

Bring To Front: Move the selected item to the front of the overlay view

Send to Back: Move the selected item to the back of the overlay

Align Left: Aligns selected controls to the same left coordinate of the last selected control.

Center Align: Aligns selected controls to the same center coordinate of the last selected control.

Right Align: Aligns selected controls to the same right coordinate of the last selected control.

Align Top: Aligns selected controls to the same top coordinate of the last selected control.

Align Middle: Aligns selected controls to the same middle coordinate of the last selected control.

Align Bottom: Aligns selected controls to the bottom coordinate of the last selected control.

Align to Grid: Aligns the selected controls to the closest grid point

Size to Same Width: makes all selected controls the same width as the last selected control

Size to Same Height: makes all selected controls the same height as the last selected control

Size to Same: makes all selected controls the same height and width as the last selected control

Lock Controls: Locks all controls on the designer so that they will not be resized or moved from their original location

11.2.2 Toolbox options for General Tools

This section is designed to help familiarize you with the different options available in the toolbox for various tools. The Toolbox is dynamic, and changes depending on the object currently active in the Report Designer. The vital options of select tools are described in this section, however if you require further information, please refer to the **ActiveReport** help file included with the installation in the **Reports** folder.

If you cannot find a description of a specific property, see the previous descriptions in this section.

Label

Angle

Allows you to change the angle at which the text appears in the label.

ClassName

Sets the overall text style of the label caption (e.g. Heading1)

Hyperlink

Allows you to change the label into a hyperlink. To do so, enter an internet address inside the **Hyperlink** field.

Left

Determines how far (in pixels) from the left edge of the report the object is located. You can either enter the pixel value manually or select the object and drag it to the desired location.

Multiline

Allows you to set whether you want the text to move to the next line when it reaches the right border of the object (**Multiline** = “True”) or if you want to force the text into a single line (**Multiline** = “False”).

Top

Determines how far (in pixels) from the top edge of the report the object is located. You can either enter the pixel value manually or select the object and drag it to the desired location.

Vertical Alignment

Allows you to set how the text is aligned in the object vertically. “Top” will start the text at the top of the object and the cursor will move down with every new line, while the text is stationary. “Bottom” will start the text at the bottom of the object and the cursor will remain on the same line with every new line, while the text moves upwards. “Middle” will start at the vertical midpoint of the object and the cursor will move down with every new line, while the text will expand equally upwards and downwards.

Field

Custom

Allows you to change the object output format to General, Number, Currency, Date, Time, Percentage, and Custom. It also allows you to specify the line/border style.

CanGrow

Allows you to set whether you want the text field to become larger if the entered text does not fit within the allotted frame.

CanShrink

Allows you to set whether you want the text field to become smaller if the text does not fill up the allotted frame.

DataField

Allows you to attach the field to a datafield in a project through a DataControl (e.g. ADO). If the field is linked to a DataControl, select the desired data field from the drop-down menu. All fields linked to a DataControl in a current report are listed in the **Fields** window under the **Report Navigator** tree.

SummaryDistinctField

Specify the field name of the field used in a distinct summary function.

SummaryFunction

Set the function to be used for aggregating data.

SummaryGroup

Set the name of group section for summarization.

SummaryRunning

Determines whether the summary is a running value or not.

SummaryType

Determines the type of summary to be used.

Check Mark

Value

Allows you to determine whether the starting condition of the checkmark is “True” (checked) or “False” (unchecked).

Image

LineColor/Style/Weight

Set the properties of the lines/borders for the object.

Picture

Select the picture you wish to display in the frame. Supported graphics formats are *.bmp, *.ico, *.cur, *.jpg, *.gif, and *.wmf.

SizeMode

Specify how the picture will be displayed in the frame. “Clip” will display the picture at original size and if the frame is larger than the frame, it will be cut off. “Stretch” will adjust the image proportions to fit the frame (even if it means distorting the picture. “Zoom” will adjust the size of the picture until the entire image is visible in the frame and there is the least amount of unfilled space possible.

Line

AnchorBottom

Anchors bottom of vertical lines to section bottom.

x1, y1, x2, y2

Specify the coordinates (in pixels) of the start and end of the line.

Shape

Shape

Specify which shape you wish to display - rectangle, ellipse, or rounded rectangle.

Rich Text

MaxLength

Specifies the maximum number of characters a user can enter in the control. The default for MaxLength is 0, indicating that the text is limited only by available system resources. Any number greater than 0 indicates the maximum number of characters.

Frame

CloseBorder

Specify whether or not the bottom border line will be displayed if the frame spans across multiple pages.

Sub Report

ReportName

Sets/gets name for the sub-report.

Page Break

Enabled

Allows you to enable or disable the page-break.

OLE

PictureAlignment

Set the alignment of the contents within the frame.

Barcode

BarWidth

Set the width of the thinnest line in the code.

Caption

In barcode, the caption is the set of symbols (alphanumeric) you want to code.

Direction

Set the direction in which the code will be written.

EnableCheckSum

Set whether the checksum is used when the code is rendered.

ActiveReport

DocumentName

The document name appears in the print spooler and can be used to easily identify the report.

MaxPages

Sets or returns the maximum number of pages ActiveReports will process. Once the number of maximum pages is reached, ActiveReports will stop processing the report.

This property can be used to limit the number of output pages when running large reports and distributing the results over a slow connection.

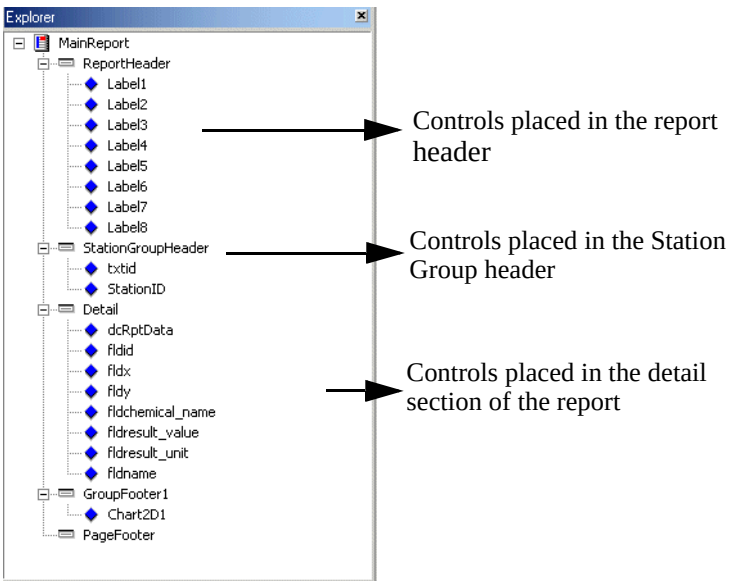
WaterMark

Adds a specified image to the report's background. The watermark image can be positioned, sized, aligned and placed on specified pages by using the other watermark properties.

11.2.3 Using the Report Designer

Report Explorer

The Report Explorer (as shown in the figure below) allows you to browse through the controls of the active report and facilitates selecting controls for further editing. The Report Explorer windows can be accessed by clicking on the Explorer icon on the toolbar.



The explorer provides quick access for selection of controls on the report. Selecting a control in the Report Explorer activates the corresponding control on the report. This makes the control ready to be formatted or moved to another location.

The explorer lists at least three nodes under the “MainReport” node, namely:

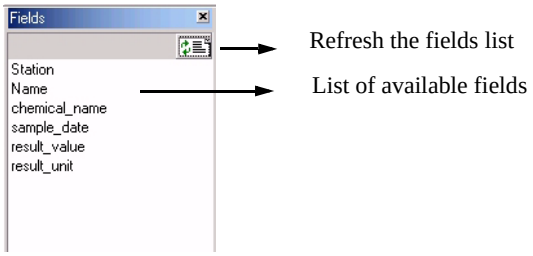
- **PageHeader**: refers to the page header for the current report
- **Detail**: refers to the section that hosts the details of the report
- **PageFooter**: refers to the page footer for the current report

Any item placed on the page header and footer of your report will be displayed on all

pages of the report. In addition to these sections, one or more sections named Group Headers and a corresponding Group Footer sections, can be added to the report. In the figure depicted above the data on the report is grouped by stations. That is, the data for each station is displayed together. Group Headers can have their own header and footer that will be displayed above and below each group's data respectively.

Data Fields Explorer

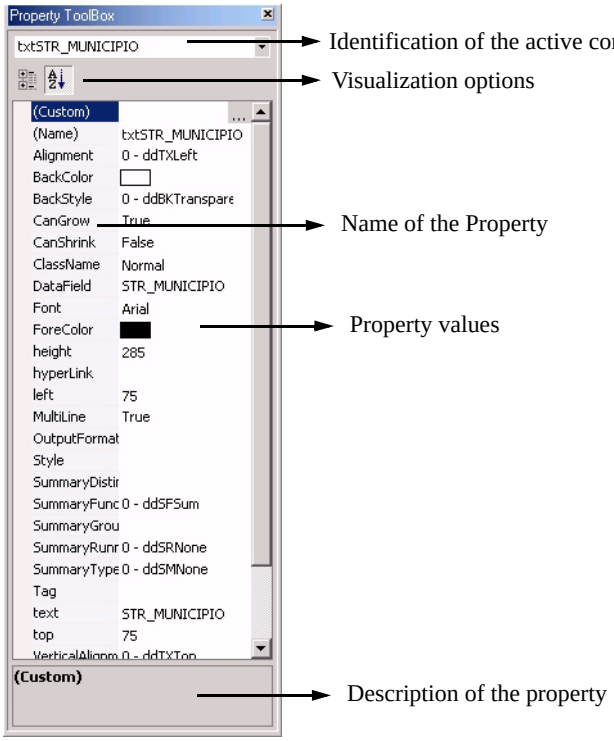
For most report types, the Report Editor takes data directly from the database, based on the design, and generates the desired report. Access to the data in the database is provided through the connection string and SQL Statement. These inputs result in a list of fields that are available for the current report. These fields are listed in the Fields Explorer (as shown below) that can be displayed by clicking on the Fields icon on the toolbar.



One or more fields in the fields explorer can be selected and dragged and dropped into the desired section of the report if displaying data from these fields is desired.

Report Properties Toolbox

The Report Properties toolbox (as shown in the figure below) provides the tools that can be used to edit properties of the report and all its sections including any controls that the report may contain. This window can be accessed by clicking on the Properties icon on the toolbar.



This window serves to access the properties of the controls that are present on the report, and it contains an orderly list with the names and values of the properties of the objects in the report, presented in the first and second column respectively.

A combo box with the list of objects whose properties can be edited is provided in the upper part of the window. Additional information for the selected property is provided at the bottom of this window.

Designer: Advanced Controls and Settings

Types of Controls

The runtime Report Designer allows you to add several types of controls to your reports. These controls range from those that are currently shown on the toolbar to all controls that are present on your computer. The types of controls that are provided on the toolbar can be grouped as follows:

Data Access Controls: ADO data control: Provides access to the database using information provided to it. Only one ADO control can be added to a given report. This control can be added to the report by clicking on the “Insert ADO Data control icon ( ) on the toolbar

Data Display Controls: Controls that can be used to display information that is either coming from the data source (database) or provided on the Report Designer. The controls that fall into this category include:

- Label
- Check box
- RTF Text
- Graphics (Image, Line, Forms, OLE objects, Barcodes, etc.)
- Page break
- Sub reports

Adding Controls

Except for ADO data control, all controls can be added to the report in the desired section. To add a control to a report:

- select the desired control by clicking on the icon on the toolbar
- position the cursor at the desired location and click-and-drag to define the size of the control

Depending on the selected control, specific dialog boxes may be displayed requesting information. Once the control is placed on the report, its properties could be altered by activating the **[Properties Explorer]** window and modifying the desired property.

The position of the controls can be changed by selecting and moving the selection to the desired location. Controls can be moved this way only within a given section. Cut and paste can be used to move controls to another section.

Some controls have special properties that require the user's attention; these controls are described below.

Altering Borders of Controls

Border properties of one or more controls can be modified by selecting the controls first and either clicking on the (Borders) button on the toolbar or selecting the option from the pop-up menu.

Modifying Data Source information of the ADO data control

The ADO data control mainly uses the connection string and SQL statement as its input to provide access to the data stored in your project’s database. Currently HydroGeo Analyst provides basic inputs for this control.

However, advanced users may want to modify these inputs in order to produce advanced reports that are supported by the Report Editor. One interesting feature provided by the Report Editor is that of generating a report based on specific values. For example, a report that displays chemical data for all stations can be modified to only generate reports for a given station and/or chemical.

The SQL statement is usually composed of the following four parts:

SELECT Field1 [, Field2, Field3,...]

FROM Table Name

WHERE Condition1 [AND/OR Condition2]

ORDER BY Field1 [, Field2, Field3,...]

where the highlighted words are internal to the SQL language, and the terms in the brackets ([]) are optional.

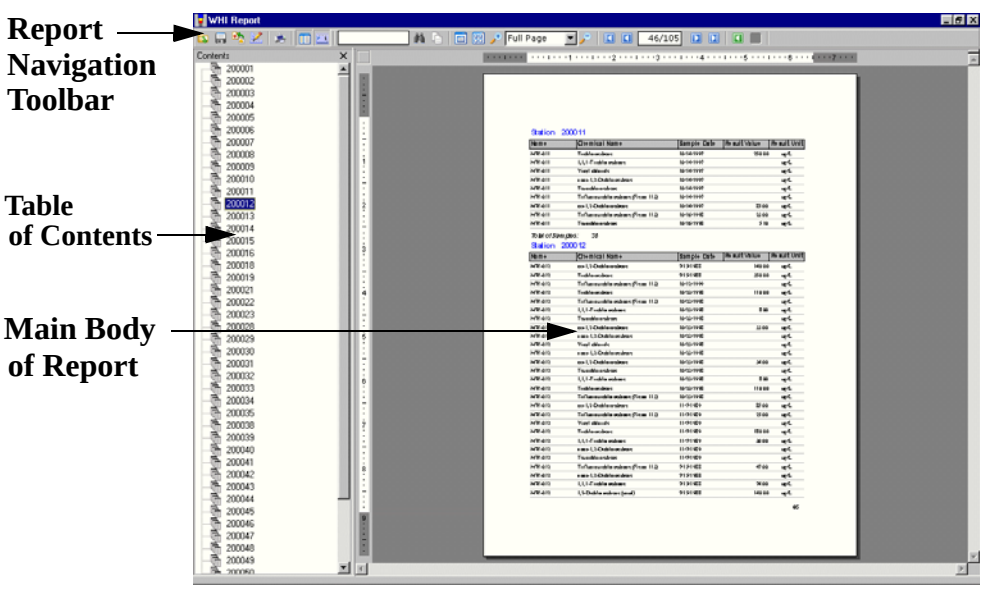
To modify the data source information of the ADO control in your report:

- select the ADO control by clicking on the appropriate icon on the toolbar
- Display the **Properties explorer** window if it is not already visible
- Select the **Custom** properties option by clicking on the button next to this item
- A dialog will appear. Provide or modify the desired options.

11.3 Report Preview Window

The Viewer allows you to visualize the final report as it would be printed. It can be considered a print preview of your reports. Once your report arrives at the viewer it is ready to be printed, saved in the native binary format of the Report Editor, or exported to the various formats. A report preview can be generated by clicking on the (Preview) button from the Designer window's toolbar.

A sample of the Report viewer window is shown below (with a report template loaded for demonstration purposes).

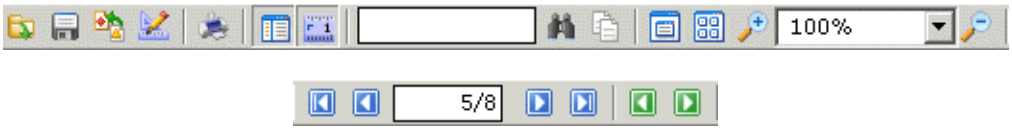


The Report Viewer contains three main components:

- **Report Navigation Toolbar:** provides a number of toolbar icons that allow you to interact with the report (described in detail below)
- **Table of Contents:** can be displayed by clicking on the TOC icon ( ) on the toolbar. The table of contents allows you to jump to any desired section in the report.
- **Main Body of the Report (Preview):** The main body of the report displays the final report as per the report design and data.

11.3.1 Report Viewer Toolbars

The Report Editor Viewer offers an extensive list of navigation tools; the figure below shows the toolbars used in the Viewer window.



The following sections describe the toolbar buttons of the viewer window.

Navigation tools

Open Static Report: Opens a previously saved static report

Save Static Report: Saves the current report in the Report Editor's native format

Export Report: Exports the current report to the desired format

Report Designer: Displays the Report Designer window

Print Report: Sends the current report to printer

Show TOC: Displays the table of contents for the current report

Show Ruler: Displays a ruler

Search Text: Allows you to provide text to search for

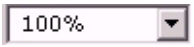
Find Text: Searches for text provided in the “Search Text” text box

Copy Page: Copies the current page to windows clipboard

Show Single Page: Displays report one page at a time

Show Multiple Pages: Displays multiple pages of the report at once

Zoom in: Zooms in to a selected area of the report

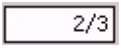


Zoom in percent: Sets the zoom level to that selected in here

Zoom out: Zooms out the report

First Page: Moves to the first page of the report

Previous Page: Moves to the previous page in the report



Page: Moves to the page specified in this text box

Next Page: Moves to the next page in the report

Last Page: Moves to the last page in the document

Back: Moves back to the previous page in a list of recently accessed pages

Forward: Moves forward to the next page in a list of recently accessed pages

11.3.2 Using the Report Viewer

Once a report is generated and displayed on the Viewer, it can either be saved in the Report Editor's native binary format, printed, or exported to various formats that are supported by the Report Editor.

Using the button on the toolbar, reports can be exported to:

- Portable Document Format (PDF)
- Microsoft Excel
- TIFF
- Hyper Text Markup Language (HTML) and
- Rich Text Format (RTF).

Please see "Exporting generated reports" on page 424, for more details.

Saving Reports

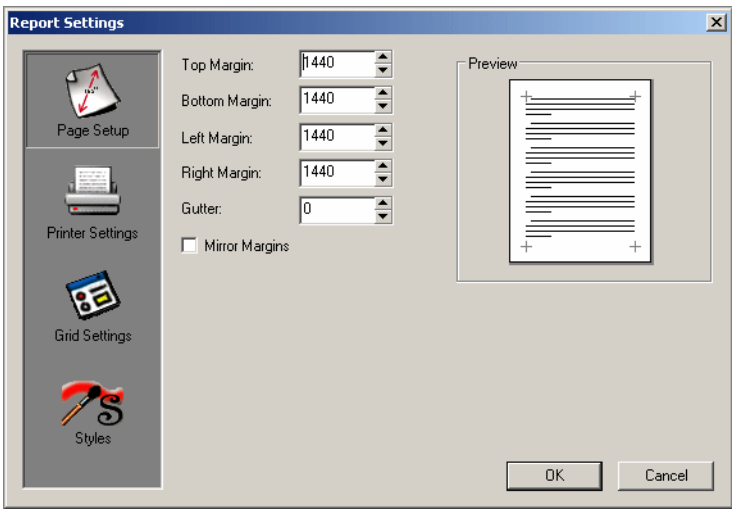
Saving the report design as opposed to the final report is preferable as the design requires a smaller storage space (for most reports) and the reports that are generated from a saved report design are dynamic - they are up to date with the data stored in your database. However, reports that are saved from the Viewer are static, and they may not reflect the exact content of the current data.

To save the report, press the (Save button) from the Viewer window's toolbar. The Report will be saved as a .RDF file (archive file).

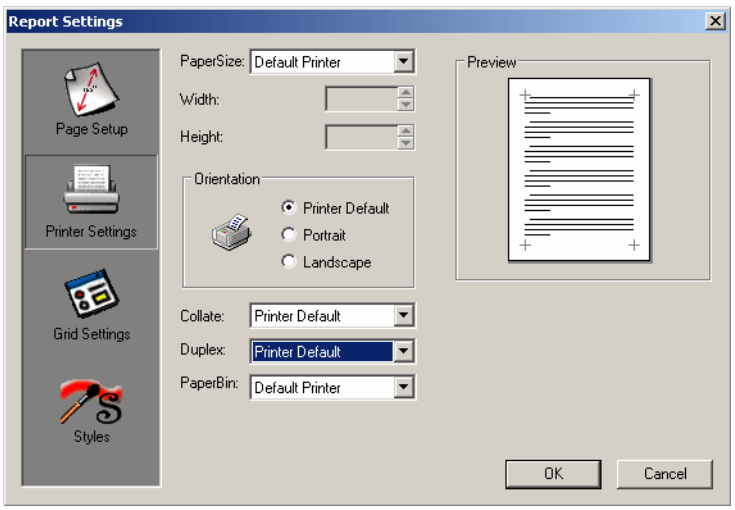
HydroGeo Analyst stores and manages all report designs in your project database. All reports that are created for your project will be retrieved from the database and are listed in the Project Browser when your project is loaded into HydroGeo Analyst.

11.4 Report Settings

The Report Settings dialog can be accessed by clicking the **Page Report** button from the **Main Toolbar**. This dialog consists of four sections: Page Setup, Printer Settings, Grid Settings and Styles. Each section is described below.



The **Page Setup** section allows you to set the page margins of your report page. Set the Top, Bottom, Left, Right and Gutter margins by using the appropriate vertical scroll bars. Margin values can be set in quarter increments (1440 = 1 inch). You may also choose to mirror the margins of facing pages by selecting the **Mirror Margins** check box.

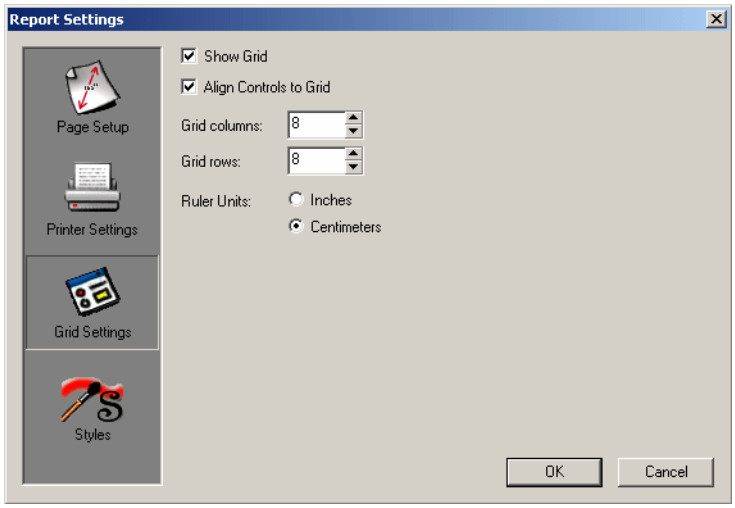


The **Printer Settings** section allows you modify the printing options. Here you can select the paper size from the **Paper Size** dropdown list box. You can manually specify the paper size by using the **Width** and **Height** vertical scroll bars.

The **Orientation** frame allows you to specify the paper orientation.

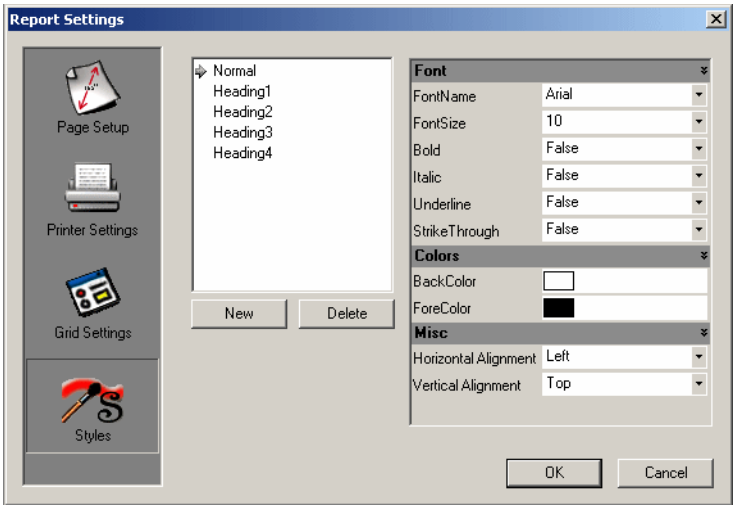
You may also choose to set the options for **Collate**, **Duplex** and **PaperBin** by using the appropriate dropdown list box.

Selecting **Printer Default** for any of the printing options will assign the default setting of the selected printer, for that particular print option.



The **Grid Settings** section allows you to modify the grid appearance of the designer window. You can set the visibility of the grid by enabling/disabling the **Show Grid** checkbox. Selecting the **Align Controls to Grid** checkbox will automatically snap controls to the nearest grid column. Set the number of **Grid columns** and **Grid rows** by using the appropriate vertical scroll boxes.

You can change the units of the ruler that appears above the designer window by clicking on either the **Inches** or **Centimeters** radio button.



The **Styles** section allows you to create, remove and modify text styles, which can then be selected from the **Text Style** dropdown box, and applied to your text controls. Text styles are useful for applying many text characteristics (font, size, bold, italic, underline etc) to your text, in just one simple task.

Click the **New** and **Delete** button to create a new style and delete a current style, respectively. The **Font**, **Color** and **Misc** settings in the right frame allow you to set and modify the text characteristics of the selected style.

11.4.1 Printing

Limitations

Although the **Report Designer** provides a detailed interface for customizing reports and templates, it is limited in the following ways:

- You cannot print multiple copies within one print event
- You cannot select specific pages to print
- You cannot select a page range to print

If you wish to print your reports using these settings, you can always export the report as a PDF and print the report(s) from a PDF Reader.

Using non-default page dimensions

If you wish to print to any non-default paper size (e.g plotter paper), you must first specify the page dimensions in three different areas within the **Report Desinger**. To do so, follow the steps below:

[1] In the Report Designer, select the **Page Setup** button from the main toolbar.

- Select the **Printer Settings** button.
- Specify the page size from the **PaperSize** dropdown box. Alternatively, define the page dimensions by selecting **Custom Paper Size** from the PaperSize dropdown box, and then entering the **Width** and **Length** values below.
- Click **[Ok]**

[2] Select the **Printer Settings** button from the main toolbar.

- Select the desired plotter from the **Name** dropdown box.
- Again, specify the paper size.
- Click **[Ok]**.

[3] Manually define the page size within the Report Desinger, by increasing/ decreasing the page extents with the mouse cursor.

Now you are ready to print your report.

11.1 Creating Reports

Reports for your project can be created from the various modules within HydroGeo Analyst including:

- Data Grids
- Borehole Log Plotter (BHLP)
- Data Query
- Map Manager
- Cross-Section Editor
- 3D Explorer

HydroGeo Analyst comes with several prepared report templates for most database schemas.

The first two report types listed above can be created through HydroGeo Analyst's main interface, while the remaining types are created only while using the respective modules of HydroGeo Analyst. The following few sections present detailed descriptions on creating each report type.

11.1.1 Creating Reports in HydroGeo Analyst-Main Window

The main interface of HydroGeo Analyst allows you to create reports in one of the following two ways:

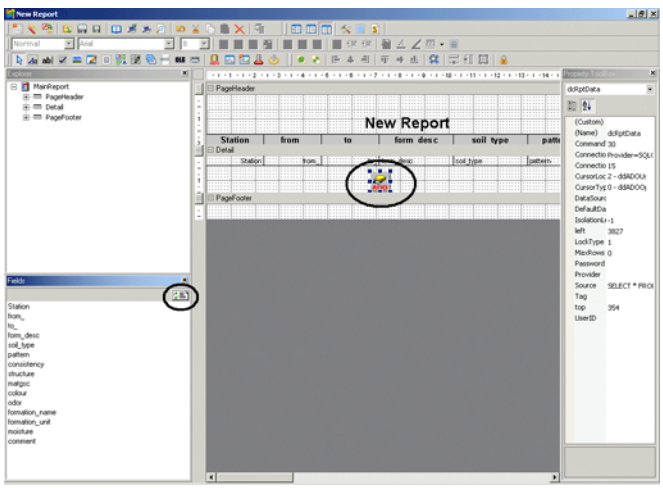
- From a Grid: create a report with the data in the selected grid
- From a selected Data Query: create a report using the results of a query

Creating Reports from a Data Grid

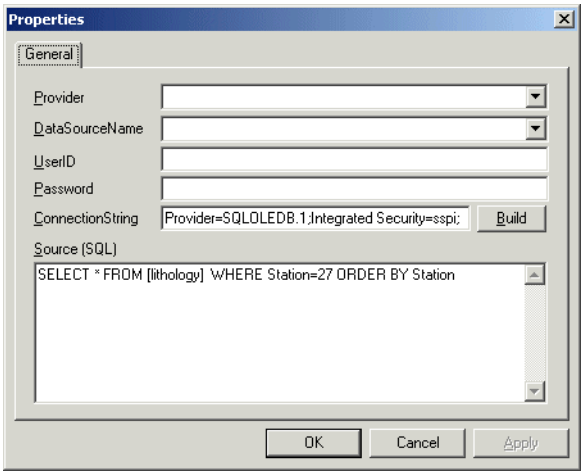
Follow the directions below to create a report containing a data grid.

- Select the desired grid in HydroGeo Analyst (for example, select the Stations List grid, or select the desired table)
- Press the Print button from the main toolbar, or select **Project / Report.** (This item is enabled only if a grid is visible and active and has at least one row of data).
- The report will be displayed in the Preview (Viewer) window, by default. To change to the Designer Window, press the (Designer) button from the toolbar. This will allow you to make any desired modifications.

The fields in the selected grid will be added to the report designer; and the ADO data control is automatically created. An example is shown below for the Lithology table:



The layout of the report can then be modified, and unwanted fields can be removed from the design. If the fields do not immediately show up in the Design window, press the Refresh button in the **Fields** frame, as circled above. To see the ADO Data control for the report, click on the button (ADO button) in the Detail section of the Report body design (also circled above). Then, right click, and select **Properties**. A dialog similar to the one shown below will appear.



In the ADO properties, under Source SQL, you can see that the SQL string has been automatically created for you, based on the table selected in HydroGeo Analyst. In this example, the SQL string basically states: Select all fields from the Lithology table, where the Station ID is 27, and order by Station. If you are familiar with the format, you may modify the SQL string here, and update the report design.

After the report is saved, a node will be created in the Project Browser, under the Reports node with the appropriate report file name. Currently HydroGeo Analyst requires that all reports be saved under the “Reports” folder, which in turn is created within the project folder. Although the Report Manager allows you to open reports from any folder, only those saved under the “Reports” folder of your project will be displayed in the project browser.

Creating Reports based on a Data Query

Follow the directions below to create a report containing a Data Query.

- Select the desired Data Query from the Queries node in the project browser (if no queries are available, create a Query using the Query Manager).
- Execute the Query in order to see the results.
- Press the Print button from the main toolbar, or select **Project / Report.** (This item is enabled only if a grid is visible and active and has at least one row of data.)
- The report will be displayed in the Preview (Viewer) window, by default. To change to the Designer Window, press the (Designer) button from the toolbar. This will allow you to make any desired modifications.

As in the previous type of report, the report will appear in the project browser once it is saved.

Creating Parameter Query Reports

A parameter query forces the report component to display a dialog box that prompts you for criteria. You can design a query to prompt you for one piece of information, for example, a station name, or for more than one piece of information, for example, two dates (starting date and end date). The report component will then retrieve all the records that contain that station name or all the records that fall between those two dates.

You can use criteria in a query to restrict the set of records that the query returns. You can then send the query results to the report component for generating a report. If querying the data for different records each time you generate a report is desired, you may want the report component to prompt you for criteria to enter, for example, Station name. A query that prompts you for criteria is called a parameter query. The following paragraphs show you how to create a dynamic report based on parameter queries.

The following is the format of the parameter query that you can create for use in the reporting component.

SELECT <fields> FROM <table> WHERE <value> = <% [Key Required] | [Optional Caption | Optional Default Value] %>

The following table summarizes the parameters that are typically included in a parameter query.

Property	Description
Default Value	Sets or returns a string expression containing the query parameter's default value. (**Select a station|Select DISTINCT '''' + Name + '''' as Name from station** in the query shown below)
Key	Sets or returns the query parameter's key (name). (**Station.Name** in the query shown below)
Caption	Sets or returns the string expression to be used as a prompt for the query parameter. (**Select a station** in the query shown below)
Value	Sets or Returns the string expression to be substituted in the query (**Name** in the query shown below)

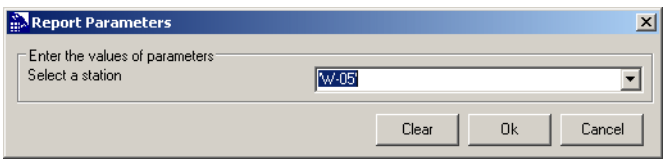
For example the bolded expression in the following parameter query forces the report component to display a dialog as shown below

SELECT Station.name as name, chem_test_results0.chemical_name, chem_test_results0.sample_date, chem_test_results0.result_value, chem_test_results0.result_unit, chem_test_results0.repORtINg_detection_limit

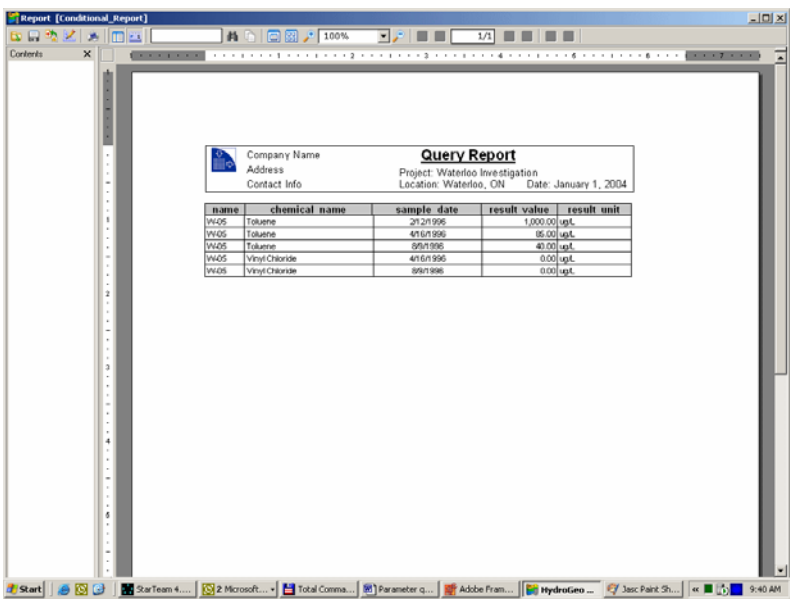
FROM (Station RIGHT JOIN PStation ON Station.ID = PStation.SID) LEFT JOIN [chem_test_results0] ON (Station.id = chem_test_results0.Station)

WHERE **Name = <%station.name|Select a station|Select DISTINCT '''' + Name + '''' as Name from station %>** and (chem_test_results0.chemical_name = 'Benzene' and PStation.ID=1

An example of a Parameter Query Report is available in the Demo project; the report name is “Conditional Report”. When you launch this report, the dialog mentioned above, will appear, prompting you to select a station:



Select one of the stations that satisfies this query... in this case, it is one of the Monitoring Wells (W-05 for example), and click OK. The report window will then appear as shown in the screenshot below.



11.1.2 Creating a Report Containing a Map Project

Follow the directions below to create a report containing one or more map layers from the Map Manager.

- Start the Map Manager, and open a Map Project
- Show/hide the desired layers in the map project (all visible layers will appear in the report)
- Press the Print button from the toolbar, or select **Project / Print** from the main menu.
- The report will be displayed in the Preview (Viewer) window, by default. To change to the Designer Window, press the (Designer) button from the toolbar. This will allow you to make any desired modifications.

The Report Editor allows you to either create a new report for the current map project or add it to an existing one. If you choose to add to an existing report, the report editor adds the new map to the report. As such, multiple views of your map project(s) can be sent to a report one by one.

Each view of your map project is created with its associated scale bar. The map project can be resized and repositioned as desired on the runtime Report Designer. Note that resizing a map project on the runtime Report Designer adjusts the scale that is associated with that specific view of your map project.

As in the previous type of report, the report will appear in the project browser once it is saved.

11.1.3 Creating a Report Containing a Cross-Section

Follow the directions below to create a report containing one cross-section created in the Cross-Section Editor

- Start the Cross Section Editor, and open a Cross-Section
- Show/hide the desired interpretation layers in the cross-section (all visible layers will appear in the report)
- Press the Print button from the toolbar, or select **File / Print** from the main menu.
- The report will be displayed in the Preview (Viewer) window by default. To change to the Designer Window, press the (Designer) button from the toolbar. This will allow you to make any desired modifications.

The report editor allows you to either create a new report for the current cross-section or add it to an existing one. If you choose to add the current cross-section to an existing report, the report editor adds the new cross-section to the report. As such, multiple cross-sections can be sent to a report one by one. In order to be able to add the current cross-section to an existing report, you must first open the existing report.

Each cross-section is created with its associated legends and key map indicating the

cross-section location in plan view. The cross-section can be resized and repositioned as desired on the runtime report designer.

As in the previous report types, the report will appear in the project browser once it is saved.

11.1.4 Creating a Report Containing 3D Images

A report for your fence diagrams and 3D views can be created by following the directions below:

- Start the 3D Explorer and open a 3D project file (.3XS), or load a 3D project from the project browser in HG Analyst
- Create the desired 3D view
- Press the Print button from the toolbar, or select **File / Print** from the main menu.
- The report will be displayed in the Preview (Viewer) window, by default. To change to the Designer Window, press the (Designer) button from the toolbar. This will allow you to make any desired modifications.

The Report Editor allows you to either create a new report for your current fence diagram or add it to an existing report. If you choose to add to an existing report, the report editor adds the new map to the report. As such, multiple views of your Fence Diagram project(s) can be sent to a report one by one. In order to be able to add the current fence diagram to an existing report, you must first open the existing report.

Each view of your Fence Diagram is created with its associated legends.

As with the previous report types, the report will appear in the project browser once it is saved.

11.1.5 Creating a Borehole Log Report

A report for your borehole log plots can be created by following the directions below:

- Select one or more stations from the Station List
- Select then open a BHLP template from the Borehole Logs node of the Project Browser
- From the BHLP designer, press the [Print] button.
- Select the desired report template.
- The report will be displayed in the Preview (Viewer) window, by default. To change to the Designer Window, press the (Designer) button from the toolbar. This will allow you to make any desired modifications.
- Print the report as is, or save to one of the supported formats.

11.1.6 Parameter Query Reports

For details on this option, please see “Creating Parameter Query Reports” on page 420.

11.2 Managing Reports

11.2.1 Opening an Existing Report

All reports saved in your project are listed under the “Reports” node in the Project Browser. To open a report, you may either double-click on the desired report or select the “Open Report” pop-up menu item by right-clicking on the desired report.

All reports are opened in the Report Designer by default. The designer displays the report layout and allows you to modify it before generating the report. The print preview of the report can be generated by clicking on the (Print Preview) button on the toolbar.

11.2.2 Deleting a Report

To delete a report that is registered with HydroGeo Analyst, select it in the project browser, *right* click on it, and select **Delete** from the pop-up menu. The selected report will be deleted both from the tree view, as well as from the file.

11.2.3 Saving a Report

A report can be saved at any time by clicking on the “Save” icon on the runtime report designer. An existing report will be saved using the same file name. When saving new reports, your will be prompted for a file name.

Saving a Report As...

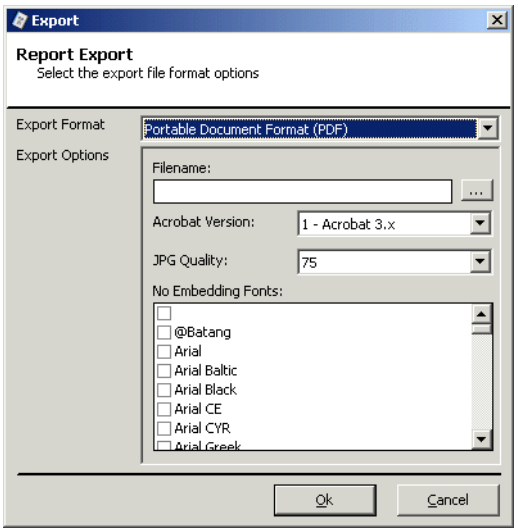
To save a report with a different name and/or as a report template, click on (Save As) icon on the Report Designer’s toolbar. You will be prompted for a file name and type. The report or report template will be saved to the “Reports” sub folder of the folder storing your project related information. The report or report template will also be saved in the project’s database, and will be made available in the appropriate node in the project browser. The report or template can be deleted from the project browser if you choose not to store it in the database.

11.2.4 Exporting generated reports

Once a report has been generated, it can be exported to various formats, as well as being saved in the Report Editor’s native format. The native format stores reports with an

RTF file extension.

To export a report, click on the (Export Report) icon on the toolbar. A dialog similar to that shown in the figure below will be displayed.



Select the desired export format, provide a file name and path, specify settings relevant to the format as desired and click on the **[OK]** button.

Reports that are saved or exported from the report viewer are not directly managed by HydroGeo Analyst and as such will not be listed in the project browser.

11.3 Creating and Managing Report Templates

The Report Editor contains pre-defined templates which allow users to quickly and easily create professional reports. Report templates can be edited, saved, and managed in the Report Editor, and new templates may be created and saved for future use.

This feature allows users to have different report layout options for headers and footers and to share them between two or more reports. This allows users to have as many report designs as desired. For example, one or more report templates can be prepared for each client with the specific header and footer. Another advantage of having a report template is that if the header information using a certain template changes, the change will automatically be applied to all reports that use the template without the need to reopen the report. For example, if the client company's telephone number changes, the user needs to change only the template instead of changing each report.

Each time a new report is created, previewed, or printed it will use the active report's

layout unless a template is specified.

11.3.1 Creating A Report Template

The Report Editor allows you to save the active report's design as a report template for future use. Once you are satisfied with the design of the currently opened report's layout, click (Save-As button) to save it as a report template. In the dialog that is displayed, provide the name for the template, check the box beside "Save as template" and click on "Save".

The template saves the header, the footer as well as the background for the detail section of the current report. The detail section may have background watermarks such as "DRAFT", "CONFIDENTIAL", etc. at desired angles and locations. The header and footer may contain: relevant information for your company and/or client including logo, name, Address, Telephone, Fax, e-mail, and web site address. The user can also configure properties such as: font, alignment, etc. for the template.

Once a report template is created, it will be listed under the "Reports" node in the Project Browser of HydroGeo Analyst.

11.3.2 Opening a Report Template

Report templates can be opened by double clicking on them in the Project Browser of HydroGeo Analyst. A template can also be opened using the report editor directly by selecting the Open button from the Designer window's toolbar and setting the file filter to "*.WTP". Once a report template is opened, it can be edited and saved.

11.3.3 Deleting a Report Template

In HG Analyst, right-click on a report template in the project browser, and select the Delete option from the menu, to delete the template. The selected template will be deleted both from the project browser as well as from storage.

11.3.4 Setting a Report Template as Default Template

To set a selected template as the default template, right click on the template and select the "Set as default" option from the pop-up menu in HydroGeo Analyst. The selected template will be set as the default template.

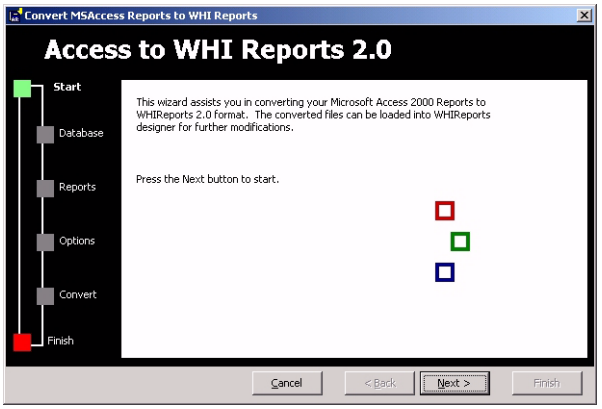
Every time a new report is created, the default template will be used to furnish the header and footer sections.

11.4 Import Reports from MS Access

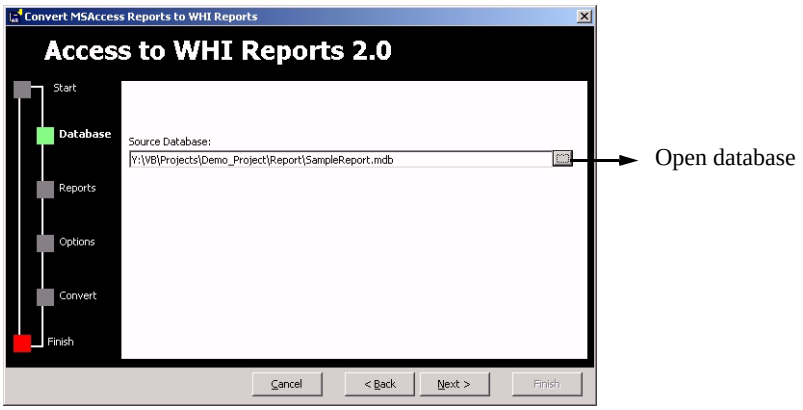
The Report Editor allows you to import reports that are created in an MS Access 2000 database environment. This may be useful in cases where you migrate existing data from MS-Access into HydroGeo Analyst, and want to import existing reports as well.

The MS Access Importing wizard can be activated by clicking on the (Import Access Report) button on the Designer's toolbar. The wizard guides you through a number of steps to import the desired report. These steps are explained in the following sections.

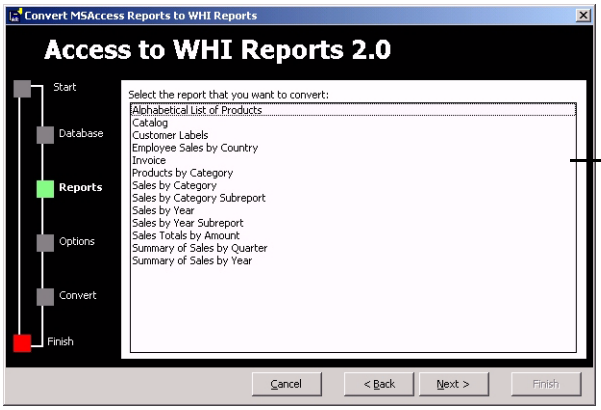
The following figure depicts the first screen of the wizard that presents some introductory text.


Convert MSAccess Reports to WHI Reports
Access to WHI Reports 2.0
Start
Database
Reports
Options
Convert
Finish
This wizard assists you in converting your Microsoft Access 2000 Reports to WHIReports 2.0 format. The converted files can be loaded into WHIReports designer for further modifications.
Press the Next button to start.
Cancel
< Back
Next >
Finish

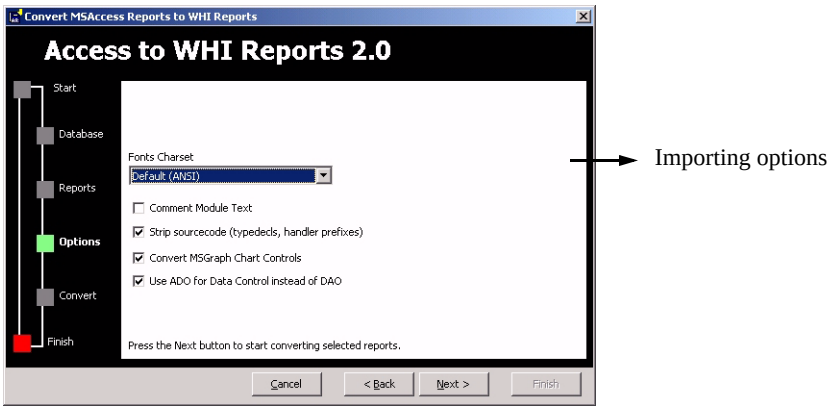
Clicking on the **[Next]** button displays the second dialog, requesting the MS Access database name that will be used as a source for the reports to be imported. Provide the database name by clicking on the **Open Database** button to the right of the text box, or alternately type in the name including the full path.



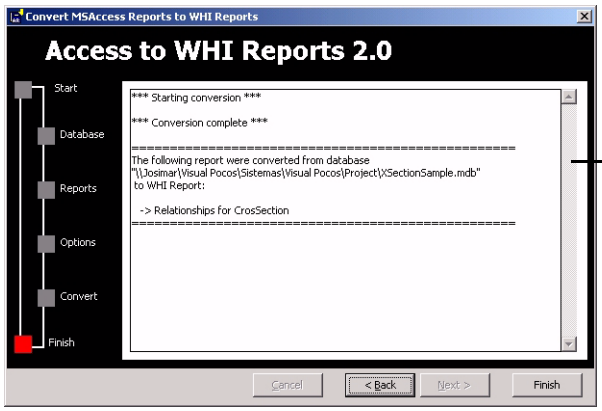
Click on the **[Next]** button to display the next dialog, listing all reports that are available in the selected database. Select the desired report and click on the **[Next]** button to proceed.



The dialog shown below will be displayed. It allows you to specify some settings that will alter the converted report. The default values are fine unless a change is desired.



Click on the **[Next]** button to start converting the report to the Report Editor's native format. A dialog will appear displaying the progress of the report conversion. Once conversion is completed, the dialog displays the summary report as shown in the following figure.



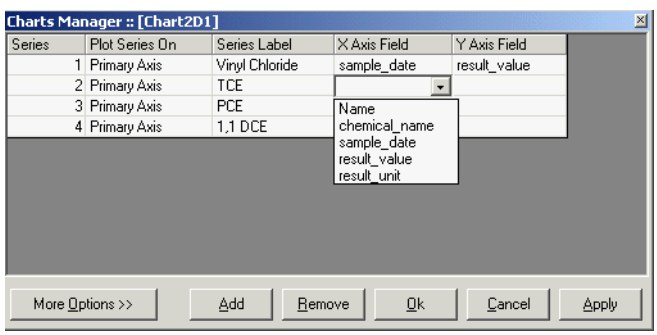
Click the **[Finish]** button and the converted report will be displayed in the runtime designer. Once all desired modifications are done to the report, it can be saved using the procedure discussed earlier.

The final report can be visualized by clicking on the (Report Preview) on the toolbar.

11.5 Creating Reports with Charts

Various types of charts can be added to your report, using the chart control. To add a chart to a report, click on the (Chart) icon on the toolbar and place it at the desired location following the procedure outlined earlier in this chapter.

Once the chart control is placed on the runtime report designer, its properties can be set by activating the control and clicking on the (Charts Manager) icon on the toolbar. The dialog shown in the figure below will be displayed.



The dialog allows you to add as many series as desired, and select the fields that will be used as the data source for the horizontal (X) and vertical (Y) axes. (The fields are obtained by loading a data query into the report. See the example below). Indicate whether a series will be plotted on the primary (on the left side) or secondary (on the

right side) vertical axis.

The properties of the chart can be set by right-clicking on the chart control and selecting the **[Properties]** pop-up menu option.

When you are finished designing the chart(s), and other parts of your report, you can generate a report preview by clicking on the corresponding icon ( ) on the toolbar.

Plots of data can be grouped by location and/or any other field by creating the necessary grouping.

11.5.1 Example

The following example illustrates the procedure for creating a time series chart, in the HGA Demo project. For this example, you will chart the TVOC chemical concentrations, observed at the Monitoring Wells.

The first step is to create a data query which will contain the fields of interest. To do this, open the Demo project, then load the Query Builder:

(For help, please see Chapter 7: Queries).

- ☞ **Tools / Query Builder** from the main menu
- ☞ **Data Query** radio button
- ☞ (New button)

Define a name for the query in the dialog that appears.

type: Chart - TVOC

- ☞ **[OK]**

In the lower-left corner of the Query Builder window, select the **Source Conditions**. The options are Project, Station Group, and Database.

- ☞ Station Groups
- ☞ Monitoring Wells

Next, add the fields for the query. For charting purposes, it is not necessary to define conditions for the fields, simply add the fields to the Display fields. Also, the coordinates are not necessary, so the Map Ready option can be disabled.

- ☞ Check the box beside **Map Ready**, to turn OFF this feature.

The fields for the query can be selected from the tree structure on the left side of the window.

- ☞ + beside Monitoring Wells
- ☞ + Chemistry Results

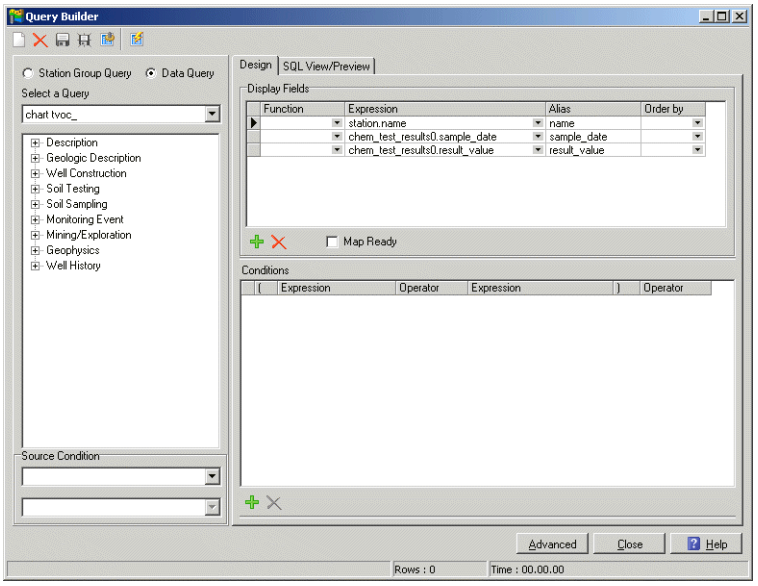
☞ **Sample_Date**. Click once on the field, and drag this field into the **Display Fields**, at the top of the window.

Repeat this for Result_value field

☞ **Result_Value**. Click once on the field, and drag this field into the **Display Fields**, at the top of the window.

(If your data is contained in different fields and/or tables, select these fields now).

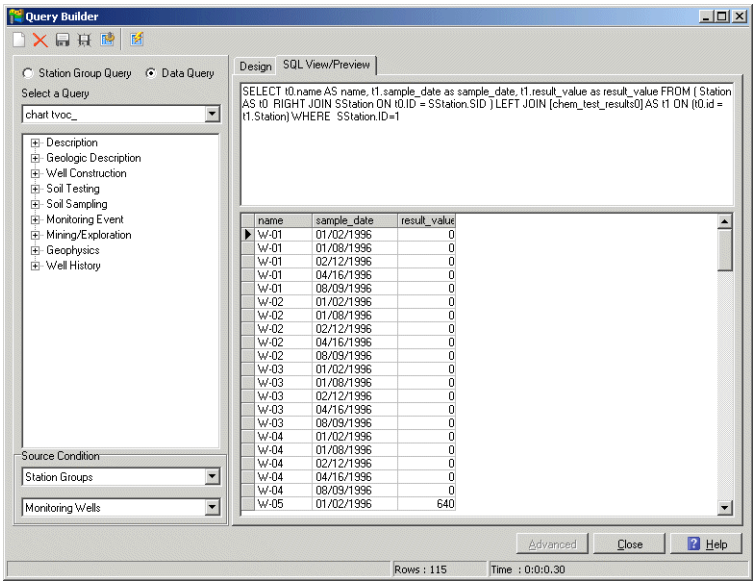
Once you are finished, the Query Builder window should be similar to the one shown below.



☞ (Generate SQL Statement) button at the top of the window to Generate the SQL string. If the query string is invalid, the violating rows will be highlighted red (indicating error) or yellow (indicating warning).

☞ (Execute SQL Statement) button at the top of the window to execute the query string.

☞ **SQL View / Preview** tab to see the results of the query. The results of this query are shown in the window below:



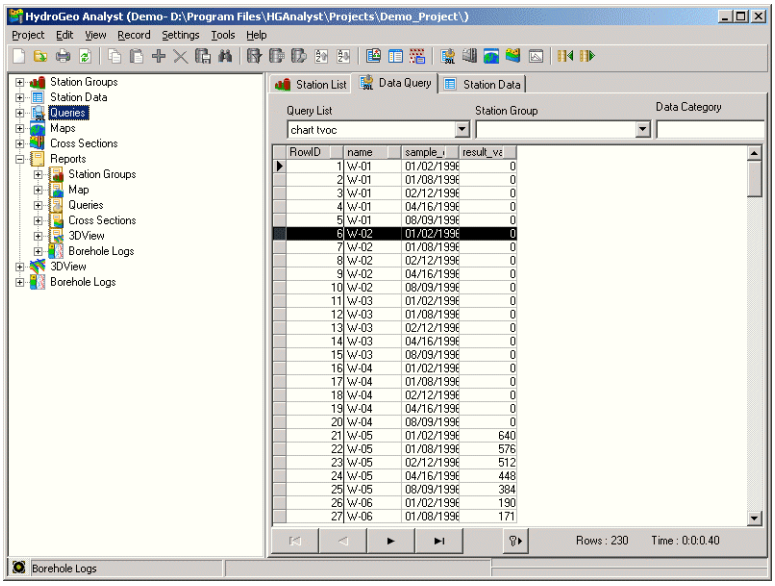
The query will return all records containing a sample date and result value in the Monitoring Wells station group. In this example, there are 115 records. (5 samples collected from each of the 23 monitoring wells). The Query Builder may now be closed.

- ☞ **[Close]**
- ☞ **[Yes]** to save the query.

The next step is to execute the query in HGA, and send this to the Report Editor.

- ☞ **Queries** node in the project tree
- ☞ Right-click on the **chart tvoc** query
- ☞ **Execute** from the menu that appears.

The query will be executed and will be displayed in the **Data Query** tab.



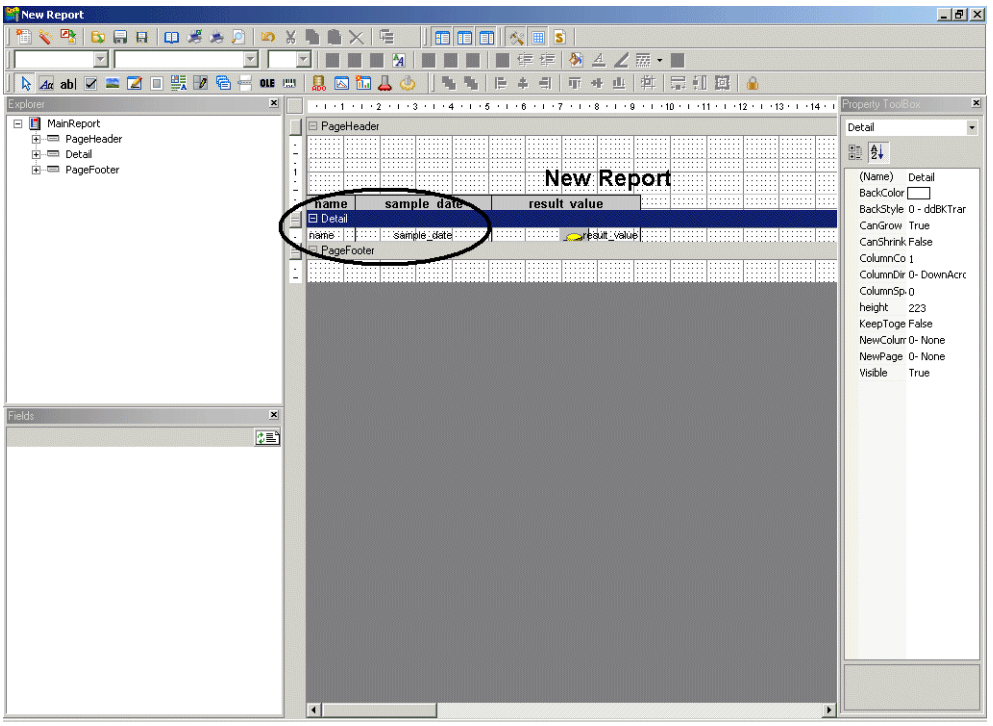
☞ **Project / Report** from the HGA main menu bar

A prompt will appear to select a Report template; this is optional.

☞ **[OK]**

The report preview window will be displayed. In order to add the chart, you must return to the report designer.

☞ (Return to Designer) button from the toolbar. The designer window should appear, as shown in the figure below.



For display purposes, it will be advantageous to add a group header, to group the data by station name. To do this,

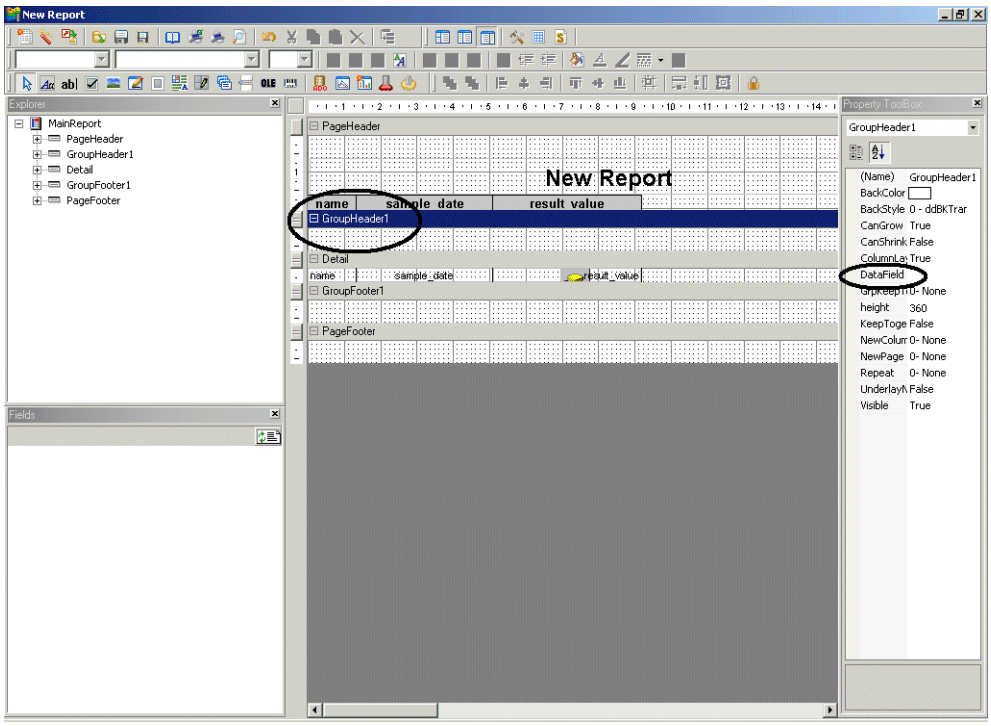
- ☞ Right-click on **Detail** in the report design window, as circled in the image above.

A pop-up menu will appear.

- ☞ **Insert**
- ☞ **Group Header/Footer**

A new Group Header and Group Footer will appear in the Report Designer window.

- ☞ **GroupHeader1** in the report design window
- ☞ (Properties) button from the toolbar. The Property Toolbox frame will appear as shown below:

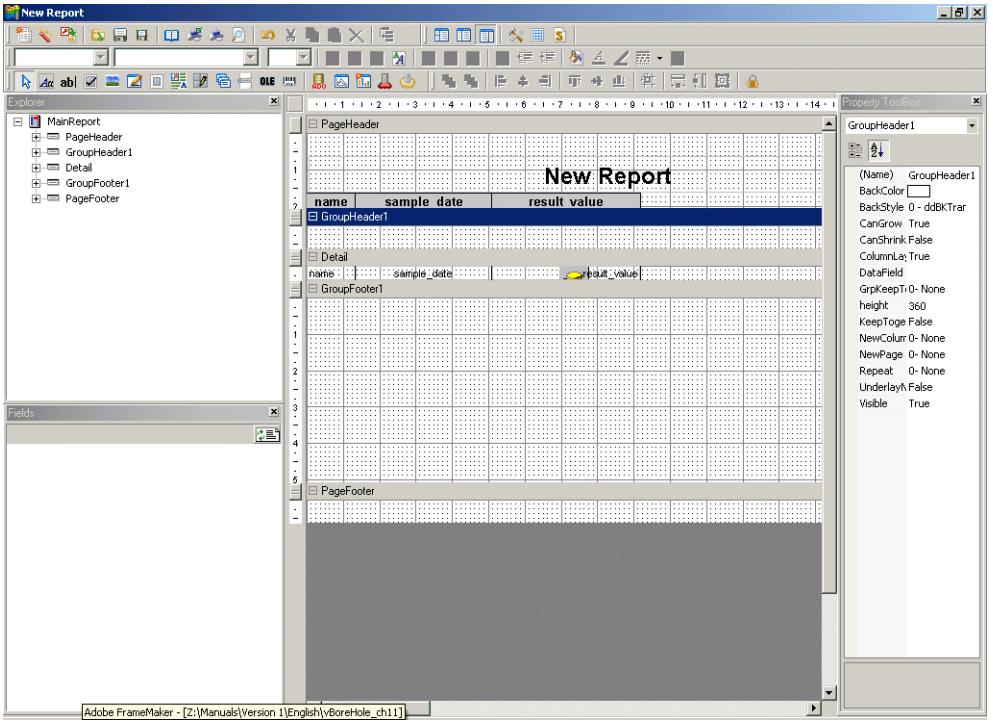


Locate the DataField entry in the Property Toolbox. (this is circled in the image above)

☞ Expand the combo box beside **DataField**, and select **Name** from the list. If there are no fields available in the list, type **Name** in this field. By specifying this option, the Report Editor will group the data by the station Name field.

The chart can now be added to the report.

☞ **GroupFooter1** in the report design window, and enlarge the space allocated to this component (see the design below). The GroupFooter will contain the time series chart, and as such, there must be adequate space allocated.

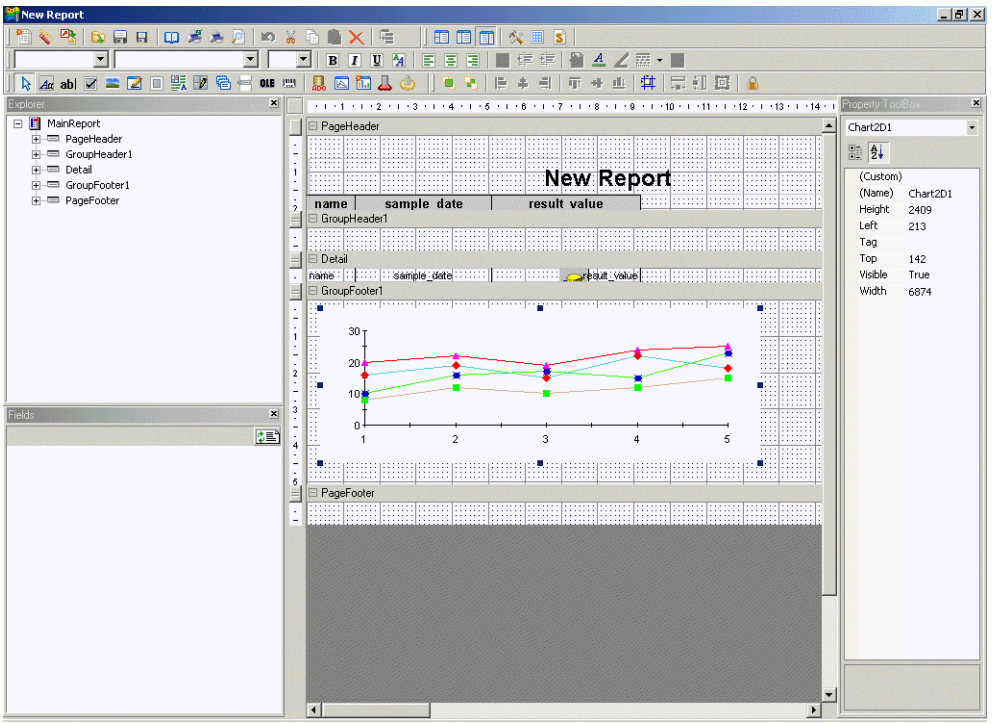


The chart should be added to the GroupFooter1 section of the report design.

☞ (Chart Object) button from the toolbar.

Using your mouse, draw a rectangle in the GroupFooter1 area of the report design, that nearly fills the allotted space.

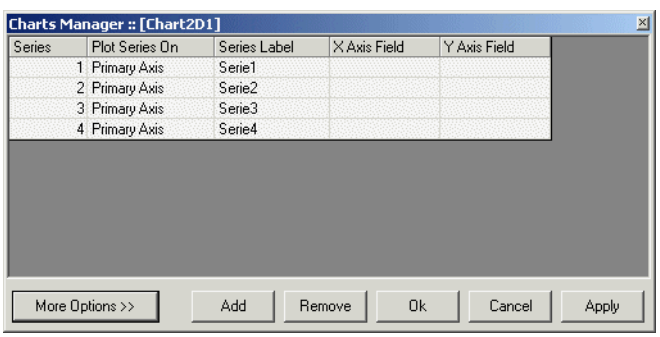
A sample plot image will appear as shown below.



To modify the chart settings,

☞ (Charts Manager) button from the toolbar.

The dialog shown in the figure below will be displayed



This dialog allows you to add as many series as desired, and select the fields that will be used as the data source for the horizontal (X) and vertical (Y) axes.

For this example, only one series is required. Use the **Remove** option to delete Series 2, 3, and 4.

For Series 1, define the following settings:

For the Series Label,

type: TVOC (ug/L)

For the X Axis Field,

☞ **sample_date** from the combo box

For the Y Axis Field,

☞ **result_value** from the combo box

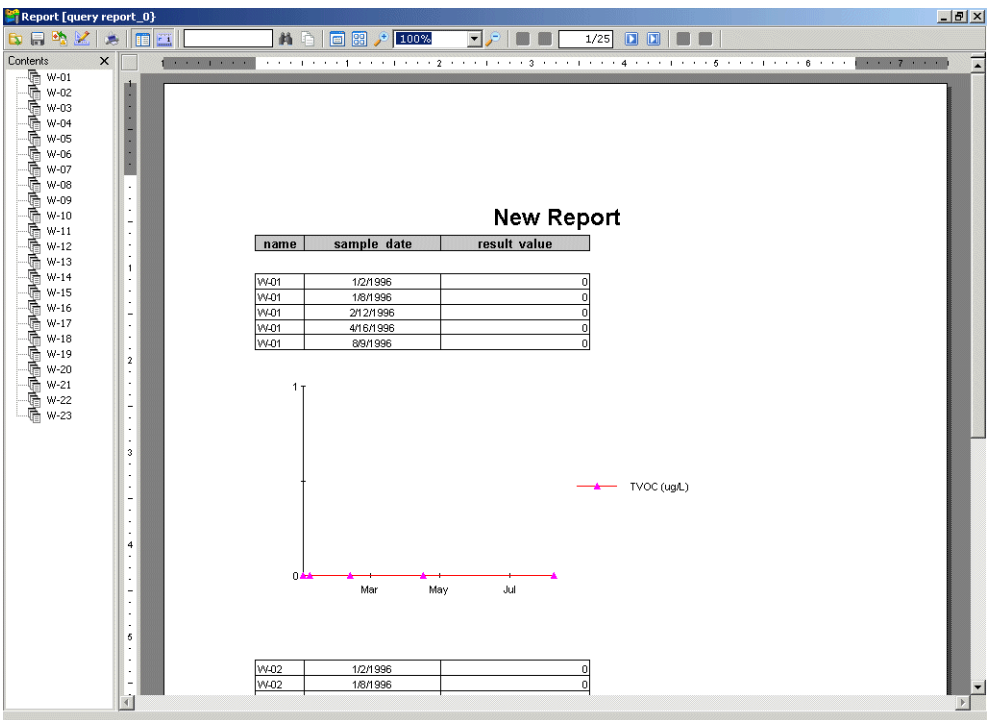
The remaining settings can be left as is.

☞ **[OK]** to return to the Report Designer.

When you are finished designing the chart(s), and other parts of your report, you can generate a report preview,

☞ (Report Preview) button from the toolbar.

Please be patient during this process, as it may require a few minutes to pass the data from HydroGeo Analyst to the Report Preview (the report contains approximately 25 pages). Once this is complete, you should see the preview window, with the table of contents, as shown below.



The report preview displays the first station (W-01) by default. Since there are no observed concentrations for this well, the time series chart is not useful in this case. Scroll ahead a few pages to see a station which contains data. Or, select a station from the table of contents (on the left side of the window), to see the respective time series chart.

☞ **W-12** from the table of contents

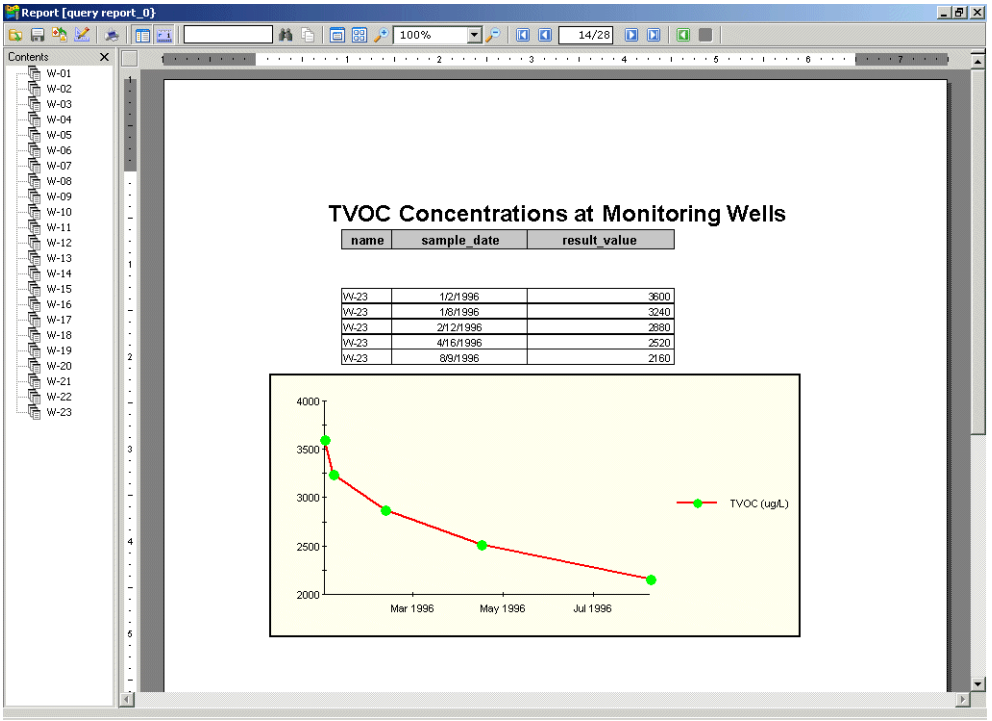
The report preview will jump ahead to this station, and display its respective data and time series chart.

If the report pages are cut off, return to the designer window to re-size the chart area, or add a page break.

The Report can be saved now to be recalled later on.

☞ (Save) button from the toolbar. The report will appear in the HGA Project browser, under the **Reports / Queries** node.

Feel free to modify additional properties of the chart, by returning to the Report Designer, right-clicking on the chart control and selecting the **[Properties]** option from the menu. In the Chart properties, you may modify axis, symbol and line properties, in addition to numerous other features. An example is shown below with some of the chart properties enhanced. An example of the modified chart is displayed below:



This concludes Chapter 11.

12

Borehole Log Plotter

The Borehole Log Plotter (BHLP) is a tool that can be used to display detailed information pertaining to a well (borehole). Information related to a borehole that may be displayed through the plotter includes:

- Lithology information for each formation
- Description of the geologic formation
- The depth and or elevation of each layer
- Well construction details (casing, screens, annular fill)
- Charts that display one or more data types collected at various depths in the well including those resulting from geophysical investigations
- Symbols showing sample locations, groundwater levels, etc.

In a typical borehole log report, there may be one or more instances of the items listed above. The number of columns, and their order of display, is flexible and can be set at the time of designing the borehole log plot and edited at any point thereafter. Borehole log plots can be created for one or more boreholes at once based on a desired borehole log plot design. Once the design is acceptable, a borehole log report can be generated for any or all boreholes in the selection through the use of the Report Editor.

Borehole log reports, once generated, can be exported to various formats (including HTML, RTF, PDF) that are supported by the Report Editor.

The borehole log plotter can also be used as a data entry assistant in HydroGeo Analyst, by displaying well construction details as data is entered in tables that are related to the Borehole log plot. Moreover, the borehole log plotter is an invaluable tool in the process of making geologic and hydrogeologic interpretations of your data under the Cross-Section Editor.

12.1 About the Interface

The BHLP may be launched from HydroGeo Analyst in several ways:

- Existing BHLPs can be opened from the **Borehole Logs** node in the Project Browser by either double-clicking on the desired borehole log plot in the available list, or by right-clicking and selecting the **Open** pop-up menu option.
- To create a new BHLP template, right-click on the **Borehole Logs** node (on the Project Browser) and select the **New** pop-up menu option

NOTE: A station group containing at least one borehole needs to be selected in order to launch the BHLP from the HydroGeo Analyst main interface.

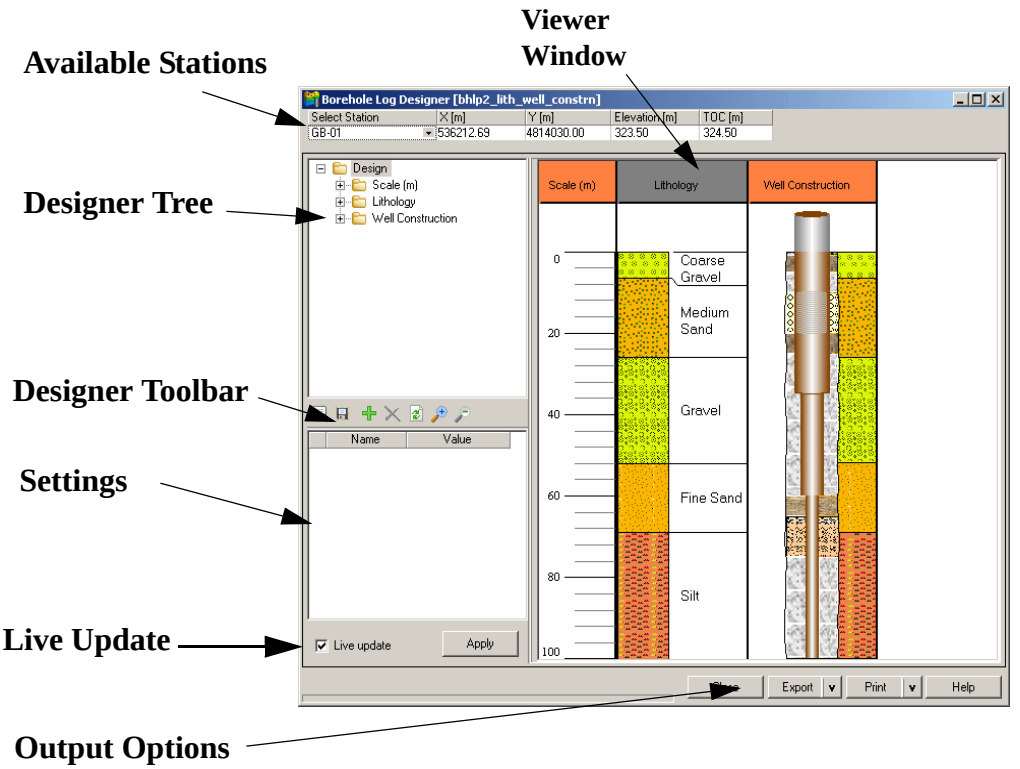
The BHLP can also be launched from the Map Manager and Cross-section editors by:

- Clicking on the (View BHLP) button in the toolbar (or **View > BHLP** from the menu), and clicking on a station to select it.

You may also view a BHLP in the HGA main window, by selecting **View > Well Profile** from the menu, and clicking on the desired station in the station list.

The BHLP will load, and display a borehole log plot of the selected station using one of the available BHLP templates. The template being used can be changed using the pull-down menu at the top of the BHLP window.

A typical BHLP window is shown in the following figure. Please note that a BHLP opened through the Map Manager/Cross Section editor will not have as many options.



The BHLP dialog contains the following items:

- A list of all **Available Stations**: Select the station for the BHLP
- **Designer Tree**: Contains the columns and related entities for the BHLP design
- **Designer Toolbar**: Toolbar buttons used for modifying the BHLP design
- **Settings**: Contains the settings for the selected entity.
- **Viewer Window**: Contains a real time view of the BHLP.
- **Output Options**: Allow you to export, or print, one or all BHLPs

Live Update

When this feature is enabled, the Borehole Log Plot Designer will automatically refresh (update) whenever an entity is defined or modified in the entity settings. The time it takes for the BHLP designer to refresh, depends heavily on the volume of data being displayed on the BHLP; a BHLP displaying a lot of data will take longer to refresh. In this case, it may be desirable to disable the automatic refresh to avoid the extended refresh times, when making changes to the entity settings. To do so, simply uncheck the **Live Update** checkbox, make all the necessary modifications to the entity settings, and then click the **Apply** button to refresh the BHLP.

12.1.1 Description of Designer Toolbar Items

The BHLP designer toolbar provides the controls and commands for the BHLP design. The following buttons are available.

Save button saves the current borehole log plot.

Save As button saves the current borehole log plot with a new name.

Add button adds a new group, column or plot entities depending on the currently active node. Columns may be a scale, interval, lithology, plot, well construction, or other features.

Delete button deletes the selected group, column, or plot series.

Refresh button updates the design and displays the preview of the current borehole log plot for the selected borehole.

Zoom in button allows you to select an interval to zoom in to, and display a magnified portion of the BHLP.

Zoom out button returns to the original BHLP view.

12.2 BHLP Columns

The borehole log plotter supports a number of column types that can be presented on a typical borehole log plot. A borehole log plot in HydroGeo Analyst consists of a set of desired columns selected from the list of supported column types. The plot does not save the data being displayed, and as such avoids data duplication. A borehole log plot is generated in real time using a BHLP template and data for the selected borehole(s).

For each column displayed on the borehole log plot, it is possible to:

- Specify the column type (image, text, plot, symbol, scale), as explained below
- Select one or more fields of data to display in the column
- Select the start and end depth for the data being displayed
- Set the property of the column depending on the selected data type. For

example, if a depth-dependent graph is selected, it is possible to set the properties of the graph. If a text column is selected, the font attributes can be set.

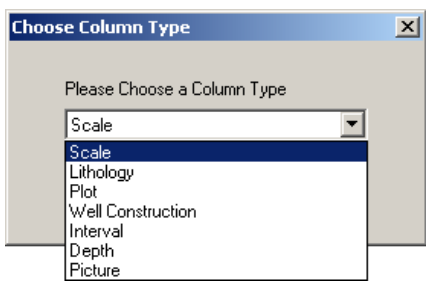
Note that each column may utilize different data fields for its start and ending depth information. For example, the start and ending depth information for Lithology patterns may be different from that of the well construction, and may come from different tables. For details on how to pre-define the data mappings for some of the BHLP column types, please see Chapter 5: Profile Settings.

Supported Column Types

The borehole log plotter supports many data types including:

- Scale
- Lithology (eg. geologic formation details, soil patterns, descriptions, etc.)
- Plot
  - Depth-dependent plots: data measured as depth-value (e.g. Geophysical investigation results (Neutron, Resistivity, Gamma), Chemistry results, etc.)
  - Interval-dependent plots: data measured as from,to-value (e.g. core recovery, sample technique
- Well construction (casing, screen, annular filling, etc.)
- Interval based data (e.g. well screen indicators, text, etc.)
  - With text entity (e.g. comments on well drilling, observations)
  - With image entity (e.g. photos of soil or split-spoon samples)
- Depth based data (e.g. symbols for water level indicator, etc.)
  - With text entity (text label showing water level values)
  - With image entity
- Picture (e.g. any image that should be applied to the entire BHLP column)

The column type may be selected from a pick list as shown below:



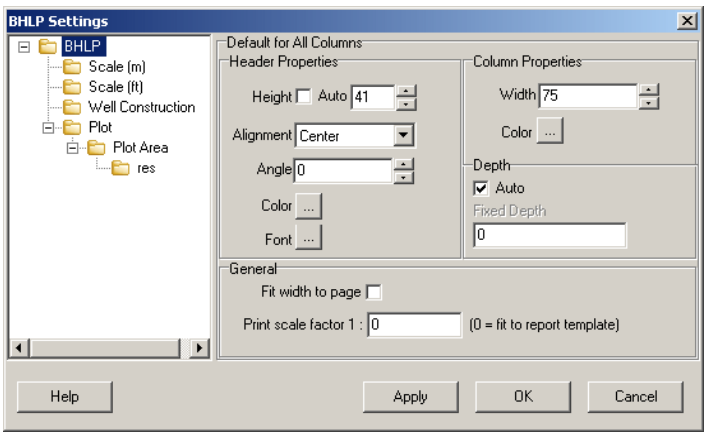
One or more instances of these column types can be displayed on a borehole log plot in any sequence. Each column can have its own header.

BHLP Default Settings

There are several default view settings and properties that can be defined for the BHLP. To load the BHLP Settings:

- Right-mouse click anywhere in the BHLP Viewer window, and select **Properties**; or
- Right-click on **Design** in the Designer tree, and select **Show Settings**

The **BHLP Settings** window will appear, similar to the following figure:



The **Header Properties** frame allows you to modify the default appearance of the column header for all BHLP columns. The following settings can be modified:

- **Height -** Set the default height of the header space. Select the **Auto** checkbox to ensure that the header text remains visible within the header space.
- **Alignment -** Set the default header alignment to **Center**, **Near** (left) or **Far** (right).
- **Angle -** Specify the default text angle. You may choose from 0°, 45° and 90°.
- **Color -** Specify the default text color.
- **Font -** Specify the default font style.

The **Column Properties** frame allows you to modify the default appearance for all BHLP columns. Here you can modify the following settings:

- Column **Width**
- Column **Color**

The **Depth** frame allows you to set a fixed column depth. If you select the **Auto** checkbox, the depth will automatically be adjusted to the depth of the “deepest” BHLP column.

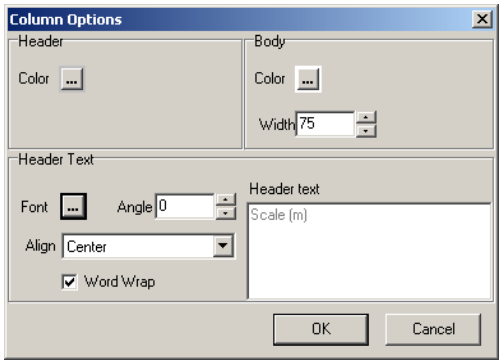
The **General** frame allows you to adjust the default general display settings for all BHLP columns. The following settings can be modified:

- **Fit width to page -** Select this option to fit your BHLP columns to the entire

width of the BHLP Viewer Window.

- **Print Scale Factor** - The default setting of 0 will fit the BHLP onto your page. However, using a whole number for the scale factor (no decimal or negative numbers) will scale the BHLP in the following manner: A Print scale factor of 1:100 would mean that 100 “units” on the BHLP would correspond to 1 “unit” on the printout. I.E. If your BHLP units are in Feet, then 100 Feet measured on the BHLP would correspond to 1 Foot in the actual printed results (so on an 8 1/2” by 11” page, 100 feet measured on the BHLP would take up just over 1 page when printed in portrait mode). The scale factors must use the same units. For more information, see “Generating a borehole log report” on page 481.

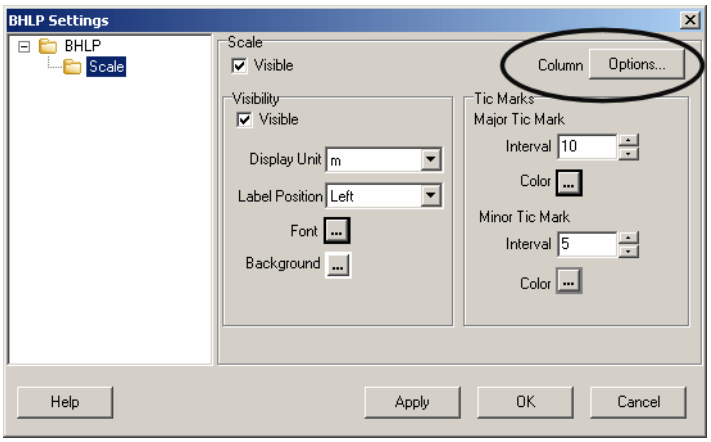
Column Options



The **Column Options** dialog allows you to specify unique display settings for each column in your BHLP. In this dialog, you can modify the **Header Color** and **Body Color** by clicking on the appropriate color box. Use the **Width** vertical scroll bars to change the width of the column.

Under the **Header Text** frame, specify the **Font**, **Angle** and **Alignment** of the column header text. Select the **Word Wrap** check box to ensure that the header text remains visible within the defined column width. In the **Header Text** text box, specify a header name for the BHLP column.

The **Column Options** dialog is available in the settings for each BHLP column, and can be accessed by clicking the **Options...** button (shown below).



Individual column settings are described in the following sections of the manual.

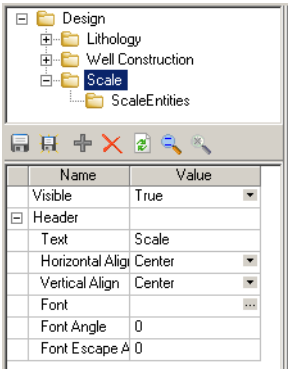
12.2.1 Vertical Scale Column

Vertical **Scale** column displays the vertical scale on the borehole log plot. Although a table and respective fields for the starting and ending depth could be provided for this column, the BHLP automatically adjusts the scale column so that the scale represents the largest column placed on the borehole log plot. One or more vertical scale columns can be placed on a given borehole log plot.

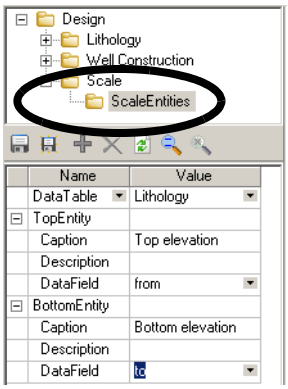
This feature may be useful in such cases where displaying the vertical scale in more than one unit (e.g. metres and feet), and/or a combination of Depth from a certain reference (e.g. top of casing) and Elevation from a selected datum, is desired.

To create a **Scale** column, click on the (Add) icon on the toolbar. From the combo box, select **Scale**. A new **Scale** column will be added to the designer window.

In the **Settings** frame in the lower left corner of the window you can set some of the visual details of the column.



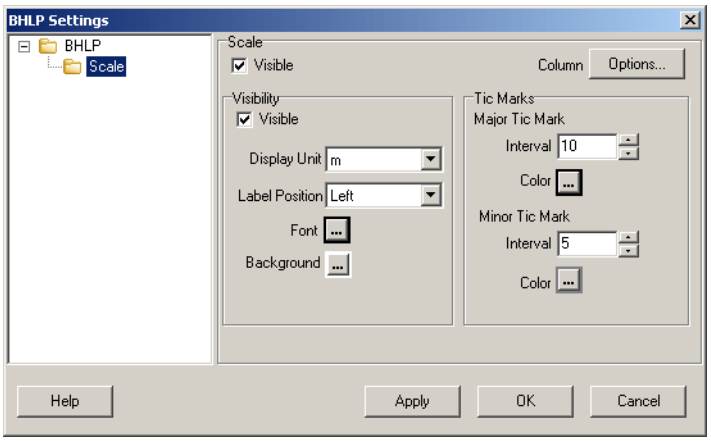
To specify the display information for this column, expand **Scale** in the Designer tree and select **ScaleEntities**.



Using the combo boxes, select the table and the fields from which to draw data. In the example shown above, the Scale column will display a depth scale that goes from the smallest “from” depth to the largest “to” depth in the **Lithology** table.

Settings

The Scale column settings are shown in the following screenshot. As mentioned previously, the settings can be adjusted by right-clicking anywhere in the BHLP window and selecting **Properties**, or right-clicking on the **Design** node and selecting **Show Settings**, then selecting the **Scale** node from the **BHLP Settings** window.



The **Scale** frame allows you to show/hide the column using the **Visible** checkbox. To access the **Column Options** dialog (page 447), click the **Options...** button.

The **Visibility** frame allows you to show/hide the contents of the column using the **Visible** checkbox, modify the **Display Unit**, and change the **Label Position**. Change the font style and background color using the **Font** color box and **Background** color box, respectively.

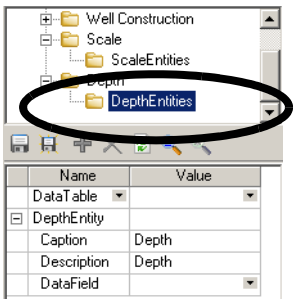
The **Tic Marks** frame allows you to set the **Interval** and **Color** of the column gradations. Clicking on a **Color** box opens a palette to select from.

12.2.2 Depth-Point based Column

The Depth-Point based column is designed to display data that has been collected at various depths. The data can be displayed using graphics, text, or both. Water Level is an example of data that could be displayed using a Depth-Point based column. Water level information can be displayed through a combination of a symbol showing the level, accompanied by a text label (e.g. showing the date at which the displayed water level was recorded).

To create a Depth-Point based column, click the (Add) icon. Select **Depth** from the combo box that appears. A new **Depth** column will be added to the designer window.

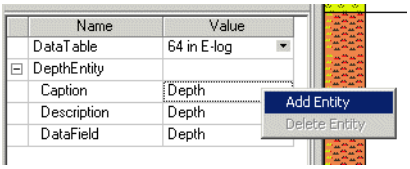
Expand the **Depth** node in the Designer tree and select **DepthEntities**.



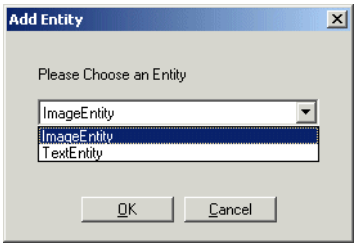
Select the data table or query, and the depth entity for the column using the combo boxes provided.

Selecting the field for the depth entity will create markers at the depths for which data is entered in the specified table or query. At this point you can select what is displayed beside (or in) these markers.

Right-click in the settings field and select **Add Entity**.

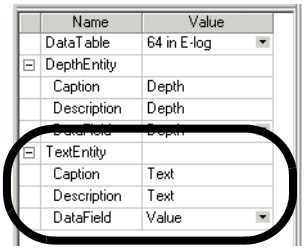


Select from **Text Entity** or **Image Entity** from the following combo box that appears:



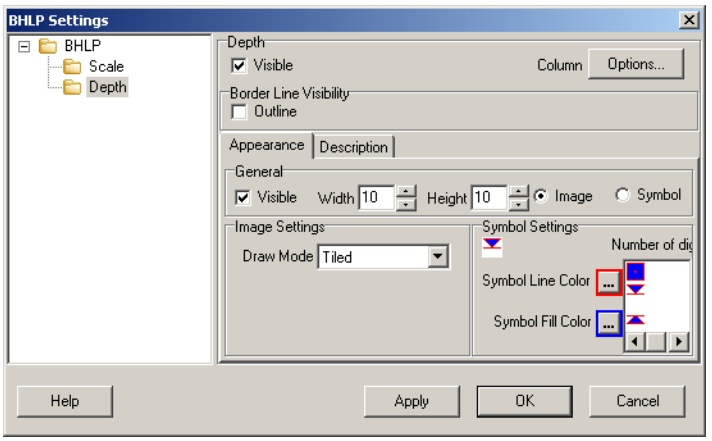
Adding a **Text Entity** will allow you to display text in the column, such as descriptions or numeric values. An **Image Entity** will allow you to display a graphical representation, such as an image, photo, or formation pattern, in addition to text.

In the **Settings** frame, select the field that contains the appropriate information for the entity you have chosen.



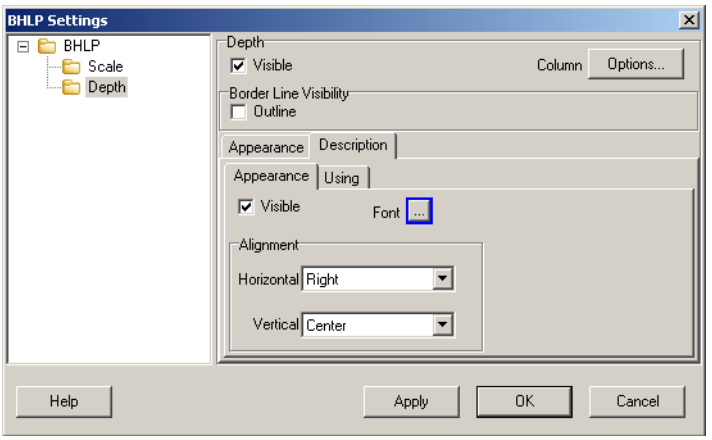
Settings

The Depth-Point based column settings are shown in the following screenshot. As mentioned previously, the settings can be adjusted by right-clicking anywhere in the BHLP window and selecting **Properties**, or right-clicking on the **Design** node and selecting **Show Settings**, then selecting the **Depth** node from the **BHLP Settings** window.

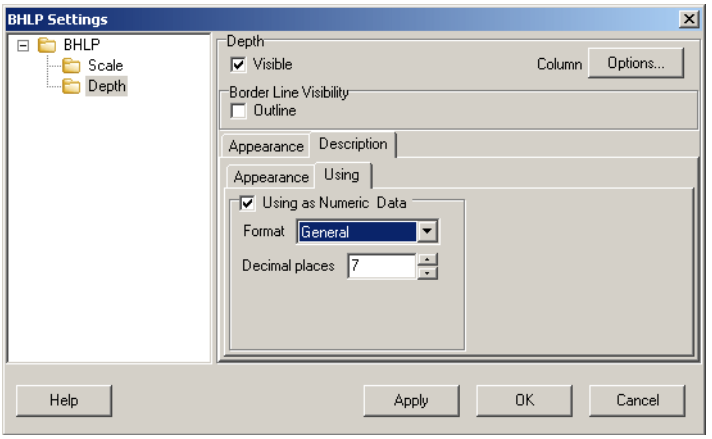


The **Depth** frame allows you to show/hide the column using the **Visible** checkbox. You can also set the general column settings by clicking on the **Options...** button (see page 447). Use the **Outline** checkbox to show/hide the column border line.

The **Appearance** tab allows you to show/hide the contents of the column using the **Visible** checkbox. You can also select from the available **Draw Modes**, change the **Width** and **Height** of the images or modify the appearance of symbols.



The **Description** tab consists of two subtabs: **Appearance** and **Using**. The Appearance subtab allows you to **show/hide** the text label, change its **Font**, and change the position of the label by using the horizontal and vertical **Alignment** dropdown boxes.



The **Using** subtab allows you to specify the display settings for numeric description data. If you choose to include numeric data in your water level description, select the **Using as Numeric Data** checkbox and specify the display format of the data using the **Format** dropdown list box. You may choose from the following formats:

- **General**: use this format to display numeric data as whole numbers (e.g 1).
- **Fixed**: use this format to display numeric data with a specified number of decimal places (e.g 1.000).
- **Scientific**: use this format to display numeric data in standard scientific notation (e.g 1.000E+0).

For both the fixed and scientific formats, you can specify the number of decimal places by using the **Decimal places** vertical scroll box.

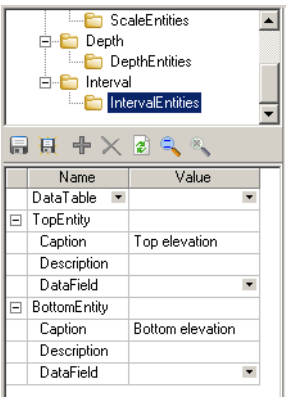
12.2.3 Depth-Interval based Column

The Depth-Interval based column is designed to display data that has been collected at various intervals. As in the case of the Depth-Point based column, the data can be displayed using graphics, text, or both. Examples of data that could be displayed using a Depth-Interval based column include screen locations, interval based samples and their descriptions, etc.

To create a Depth-Interval based column, click on the (Add) button to add a new column and select **Interval** from the combo-box that appears.

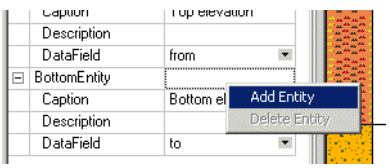
A new **Interval** column will be added to the designer window.

Expand the **Interval** node and select **IntervalEntities**.



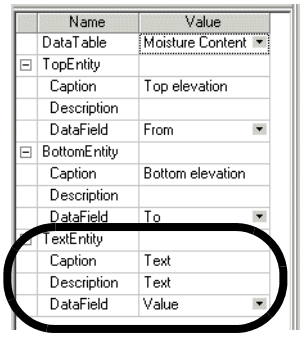
Select the data table or query and the fields for the top and bottom entity. In this column, the data table or query is any data source that contains “from-to” interval data, and the top and bottom entities are mapped to these “from” and “to” fields.

As in the **Depth** column, once the intervals have been established, the value field has to be defined. To do so, right-click anywhere in the Settings frame and select **Add Entity**.



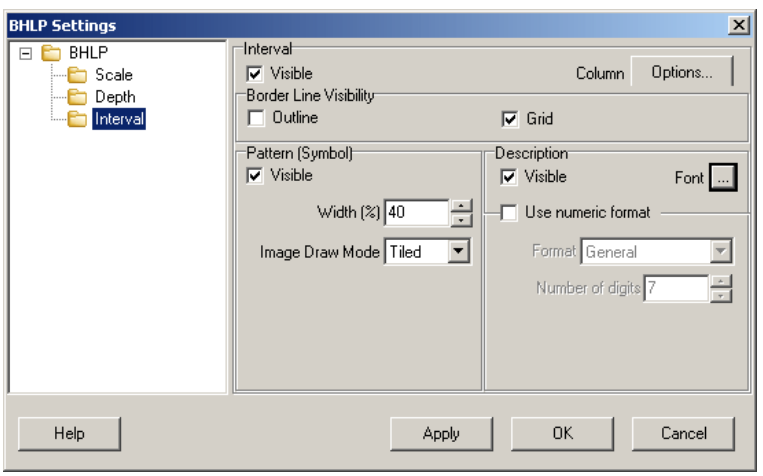
Select **Text Entity** or **Image Entity** from the combo-box, depending on the type of data you wish to display.

A new entity will be added to the **Settings** frame. Using the combo-box provided, select the field that contains the value (or image) you wish to display.



Settings

The Depth-Interval based column settings are shown in the following screenshot. As mentioned previously, the settings can be adjusted by right-clicking anywhere in the BHLP window and selecting **Properties**, or right-clicking on the **Design** node and selecting **Show Settings**, then selecting the **Interval** node from the **BHLP Settings** window.



The **Interval** frame allows you to show/hide the column using the **Visible** checkbox. You can also set the general column settings by clicking the **Options..** button (see page 447). The **Border Line Visibility** frame allows you to show/hide the column **Outline** and the **Grid** by clicking on the appropriate check box.

The **Pattern (Symbol)** frame allows you to show/hide the pattern, modify the **Width**, and change the **Image Draw Mode**.

The **Description** frame allows you to show/hide the description, and modify the **Text Font**. If you choose to display numeric data, select the **Use numeric format** check box.

Please refer to the *Depth-Point Based Column (page 450)* section for more information on this option.

12.2.4 Lithology Column

The **Lithology** column is specifically designed to display geologic formation details. It allows the use of soil (lithologic) patterns together with an optional description for each formation.

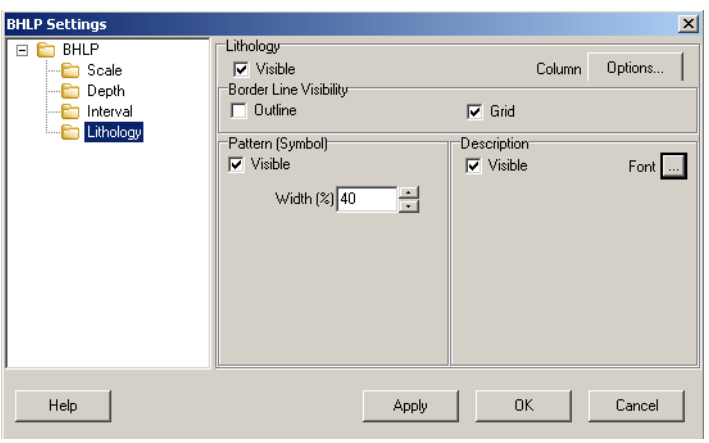
To add a Lithology column, click the (Add) button and select **Lithology** from the combo-box provided.

A new **Lithology** column will be added. In the Designer tree, expand the **Lithology** node and select **LithologyEntities**. Using the combo-boxes provided, select the data table, top, bottom, image, and text entities.

Lithology column is a specialized version of the **Interval** column, which is described on page 454.

Settings

The Lithology column settings are shown in the following screenshot. As mentioned previously, the settings can be adjusted by right-clicking anywhere in the BHLP window and selecting **Properties**, or right-clicking on the **Design** node and selecting **Show Settings**, then selecting the **Lithology** node from the **BHLP Settings** window.



The **Lithology** frame allows you to show/hide the column using the **Visible** checkbox. You can also set the general column settings by clicking the **Options..** button (see page 447). The **Border Line Visibility** frame allows you to show/hide the column **Outline** and the **Grid** by clicking on the appropriate check box.

The **Pattern (Symbol)** frame includes a **Visible** checkbox which allows you to show/ hide the lithology patterns, and a **Width (%)** vertical scroll box which allows you to set the width of the lithology pattern as a percentage of the total column width.

Under the **Description** frame, you can modify the visibility and font style of the descriptive text by selecting the **Visible** check box and **Color** box, respectively.

12.2.5 Well Construction Column

The **Well Construction** column is the most comprehensive data column in the Borehole Log Plot. It displays data from various sources in your database including:

- Drilling details
- Lithology
- Annular filling
- Casing and screens
- Centralizers
- Cap
- Pump locations
- Water Level
- Pump
- Scale

Information for the above items, and in some cases the images for patterns, are taken directly from the database.

To add a **Well Construction** column, click the (Add) icon and select **Well Construction** from the combo box provided.

Some of the entities have been selected for you. When the new **Well Construction** column appears in the BHLP Designer, it will display Lithology, Drilling, Casing, Screen, Annular Filling, and Scale data for the selected station, if it has been entered into your database. Other entities (such as pump locations) have to be entered manually.

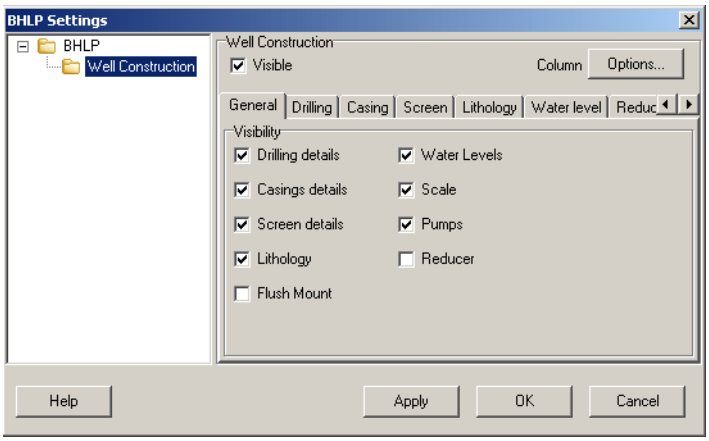
To specify the desired entity, expand the **Well Construction** node and locate the specific sub-node. Use the combo-boxes provided to set the data table and fields.

Settings

The **Well Construction** column settings are shown in the following screenshot. As mentioned previously, the settings can be adjusted by right-clicking anywhere in the BHLP window and selecting **Properties**, or right-clicking on the **Design** node and selecting **Show Settings**, then selecting the **Well Construction** node from the **BHLP Settings** window.

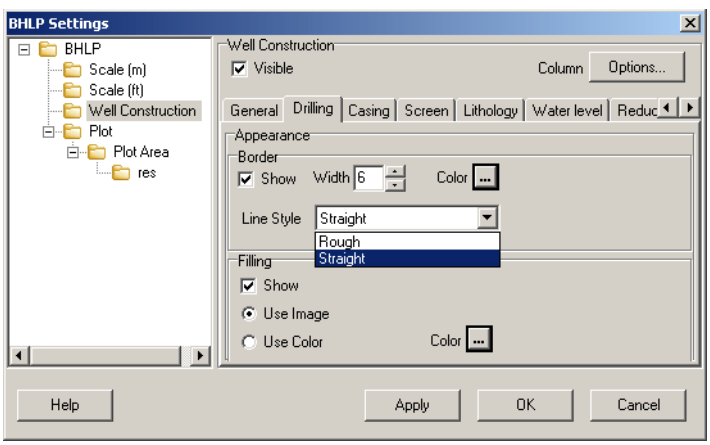
The **Well Construction** frame allows you to show/hide the column using the **Visible** checkbox. You can also set the general column settings by selecting the **Options...** button (see page 447)

General



The **Visibility** frame allows you to show/hide the various components of the Well Construction column.

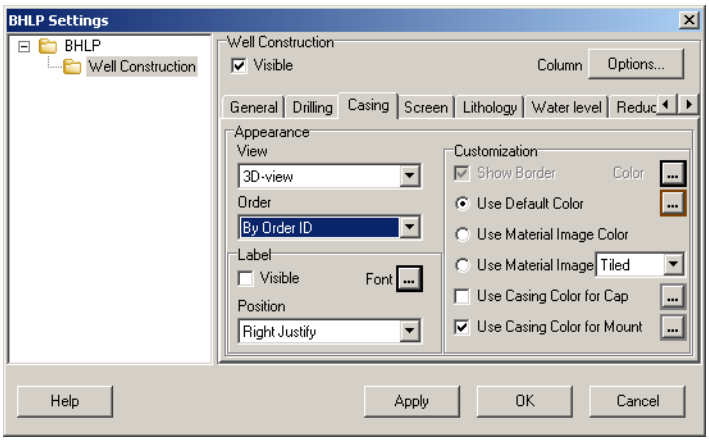
Drilling



The **Drilling** tab allows you to define the appearance settings for the annular filling. Use the **Border** frame to set the **Visibility**, border **Width** and border **Color**. The **Line Style** dropdown box allows you to select between a **Rough** (irregular) border to a **Straight** (flush) border.

The **Filling** frame includes a **Show** checkbox which allows you to set the visibility of the annular filling. You can display the annular filling in one of two ways: **Use Image** or **Use Color**. The use image option will use the images defined in the List Editor to display the filling. Otherwise, select use color, and specify a color from the **color box**.

Casing



The **Casing Settings** frame allows you to define the well casing source color, view, and order, and label settings.

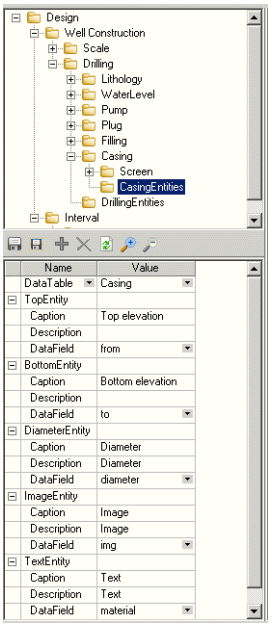
Under the **Appearance** frame, select how to display the well casing.

- Select the **View** (2D or 3D)
- Casing **Order** (left to right, right to left, centered, etc.)
- Define **Label** properties

NOTE: In order to define well casings within another parent casing, you must define the parent casing value in the Casing table. If you do not have this field, it must be added to your data structure. If you want well casings draw individually (not within a parent casing), define a value of 0 for the Parent_casing_ID.

Under the **Customization** frame, define color source for the casing (Draw Border, Use

- Draw Border
- Use Default Color
- Use Material Image color (use this option if your well casing materials were selected from a list defined in the list editor, and each list item has a corresponding color)
- Use Material Image (will use an image from the database, for the well casing; if you select this option, you must add an Image Entity to the Well Construction/Drilling/Casing entities, as shown below, and map to an image field in the database)



- Define color for the casing cap and mount

NOTE: In order to see the well casing and screens in the appropriate locations, you must add and map the appropriate entities as explained below:

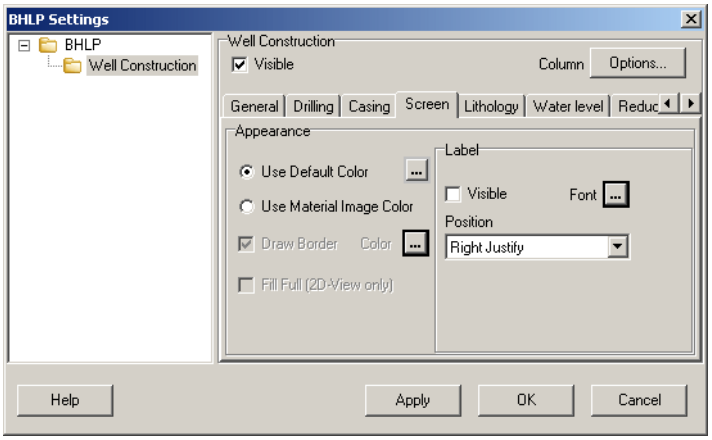
In the BHLP settings, right-mouse click, and select **Add Entity**. You may add and map any of the following entities:

- **Image:** use this option if you want to display an image of the well casing on the BHLP; you must select a field from the casing table, that contains an image.
- **Text**: use this option if you want to display a descriptive label of the casing, on the BHLP; you must select a field from the casing table, that is a string, and contains the descriptive information on the casing type/material
- **IDEntity:** select the field that contains the Casing ID
- **ParentID:** use this option if you want to display well casings nested within another casing, or on their own. You must select a field from the casing table, that is field type double, and contains values for the parent casing ID

SortBy: use this option if you want well casings to be ordered in a particular fashion on the BHLP. You must select a field from the casing table, that is field type double, and

contains values for the well casing orders.

Screen



Under the **Appearance** frame, select how to display the well screen.

- Use Default color
- Use Material Image color (use this option if your well screen materials were selected from a list defined in the list editor, and each list item has a corresponding color)
- Draw Border, and
- Fill Full (2D-View only) (use this option to apply a solid color to the well screen)

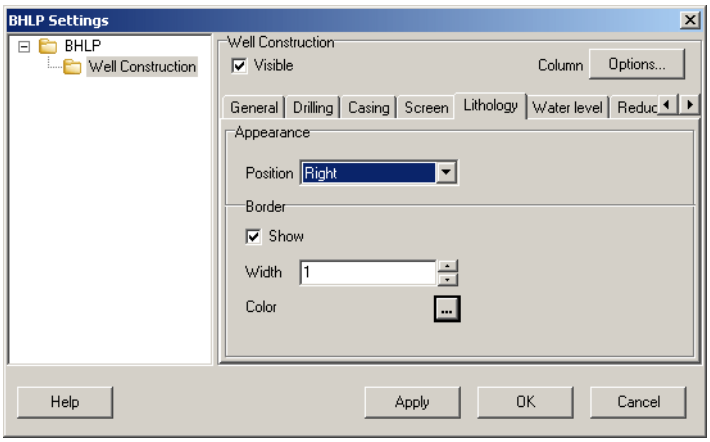
Under the **Label** frame, define the text settings for the screen labels.

NOTE: In order to see the well screens in the appropriate locations, you must add and map the appropriate entities as explained below:

In the BHLP settings, right-mouse click, and select **Add Entity**. You may add and map any of the following entities:

- **Image**: use this option if you want to display an image of the well screen on the BHLP; you must select a field from the screens table, that contains an image.
- **Text**: use this option if you want to display a descriptive label of the screen, on the BHLP; you must select a field from the screen, that is type string, and contains the descriptive information on the screen type/material
- **ParentID**: use this option to define what casing each screen belongs to. You must select a field from the screen table, that is field type double, and contains values for casing ID (in most cases, select the Casing ID)

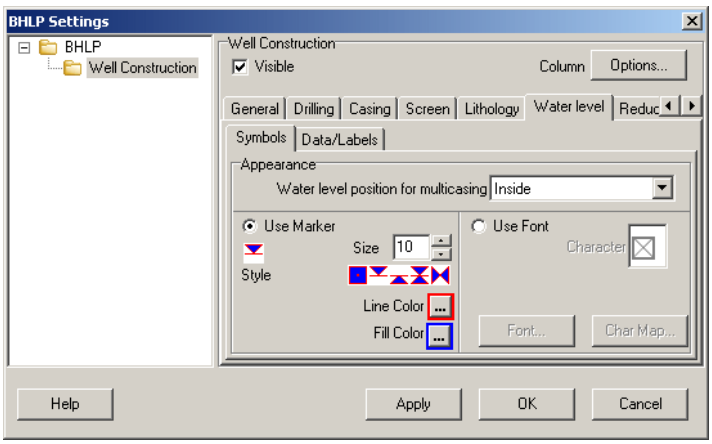
Lithology



The **Appearance** frame allows you to change the position of the lithology images layers within the cell construction column. Choose from **Right**, **Left**, **Both** (on each side of the well drilling).

The **Border** frame allows you to define the lithology border settings. You can set the visibility using the **Show** checkbox, change the width of the border using the **Width** vertical scroll boxes (0-10), and change the color of the border using the **color** box.

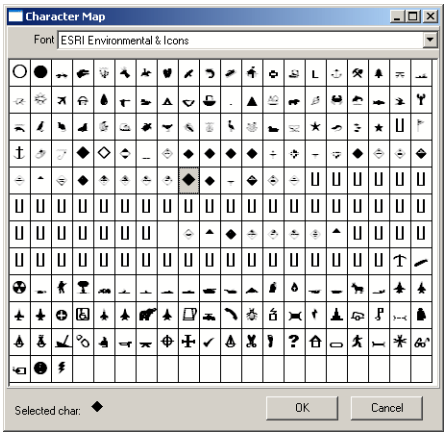
Water Level



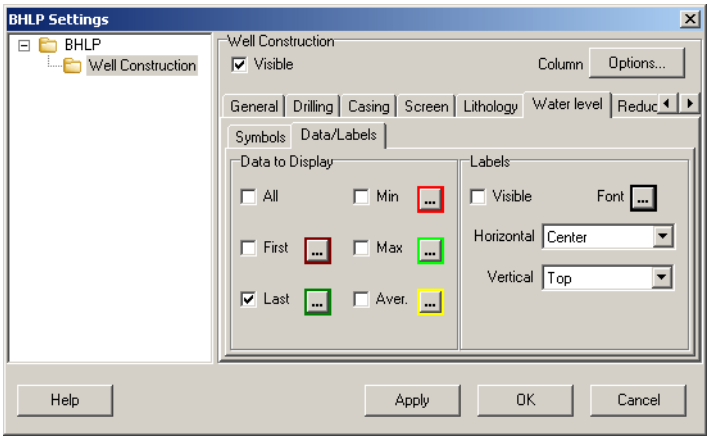
The **Symbols** tab allows you to define the symbol to represent one or more water level measurements on the plot.

Under the **Appearance** frame, you can specify the water level position for multicasing wells from the dropdown list box. You can also select the type of symbol to represent the water level positions.

- Select the **Use Marker** option, and you can select from a list of symbol markers, where the size, style, and line and fill colors can be defined.
- Select the **Use Font** option, and you can select from available fonts, size, color, etc. After the Font is selected, load the **Character Map** to see the available characters for the selected font.



Simply click on the desired character, then click **[OK]** to return.



Under the Data/Labels tab, the **Data to Display** frame allows you to select which water level(s) to represent on the BHLP. Choose from the following options:

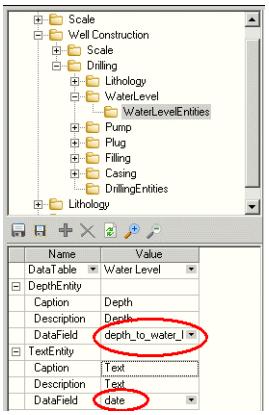
- All
- First
- Last

- Min
- Max
- Average

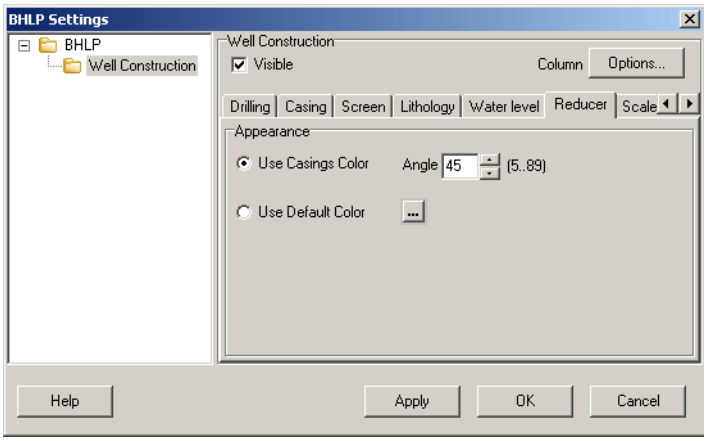
The color of each option can be changed by clicking on the corresponding color box.

Finally, the **Labels** frame allows you to specify the **Visibility**, **Font** and **Alignment** settings for the data labels.

NOTE: In order to see the water level dates displayed beside the symbol, you must map the appropriate Well Construction \ Drilling \ Water Level Entity fields as shown below; the data source may be a table or query.

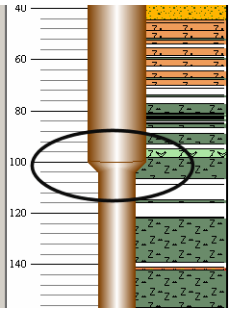


Reducer

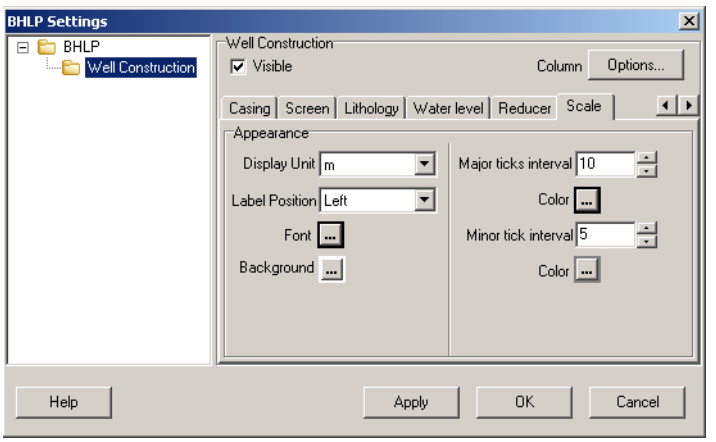


Under the **Reducer** tab, the **appearance** frame allows you to modify the display settings for pipe fittings that connect casings of different diameters (shown below). Select **Use Casing Color** to use the predefined casing color or select **Use Default Color**, and specify a different color. Use the **Angle** vertical scroll bars to change the reducer angle.

NOTE: The reducer angle must be within the range of 5° - 89°. Also, the reducer is not drawn to scale and is intended for visualization purposes only.



Scale



The **Scale** tab allows you to modify the scale within the Well Construction column. The settings for this scale are identical to those described in “Vertical Scale Column” on page 448.

12.2.6 Depth Dependent Plots

The **Plot** column is designed to display various types of depth dependent graphs. It supports both the Depth-Interval as well as the Depth-Point based data types. The following are some example data that may be displayed using this column type:

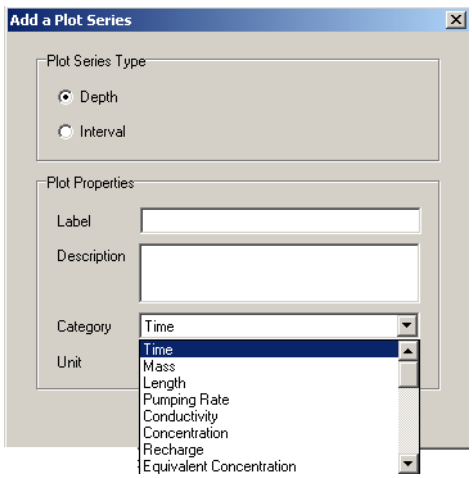
- Geophysical investigation results
- Analytical results (chemical concentration)
- Analytical results for soil physics (moisture content, bulk density, etc.)
- Soil testing results (pocket Penetrometer, SPT)

Various plot settings are available. For Depth-Point based graphs, the plot column supports the following plot types:

- Points
- Connected vertices (line graphs) with or without points
- Bar charts

For depth-interval plots, the area under the plot may be filled in.

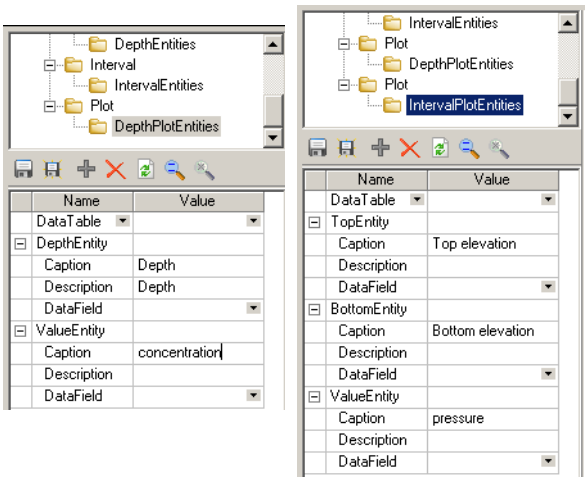
To create a **Plot** column, click the (Add) icon and select **Plot** from the combo-box provided. A new **Plot** column will be created in the BHLP Designer window. To create specific plots within this column, select the newly added **Plot** sub-node from the Designer tree and click the (Add) button again. The **Add a Plot Series** window shown in the following screenshot will open.



From this window you can define the **Plot Series Type**, and select a plot **Category** and **Unit** to use. The categories are based on the unit categories available in the current database template. Enter a **Label** for the plot, and click **[OK]**.

Depending on whether you selected **Depth** or **Interval** for your plot, the Entities displayed in the **Settings** window will be slightly different.

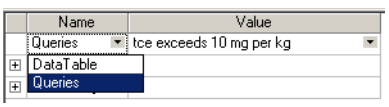
Depth **Interval**



In the first row of the table, under the **Name** column, select the data source for the plot. There are two options available: **Data Table** or **Queries**

If **Data Table** is selected, then in the **Value** column, you will see a list of Data tables from your database schema, for which you may select one table.

If **Queries** is selected, then in the **Value** column, you will see a list of Data Queries available in your HGA project, for which you may select one table. The advantage of using Data Queries, is that the fields may originate from one or several tables in your database.



The **Caption** corresponds to the text you entered in the **Label** text box of the **Add a Plot Series** window.

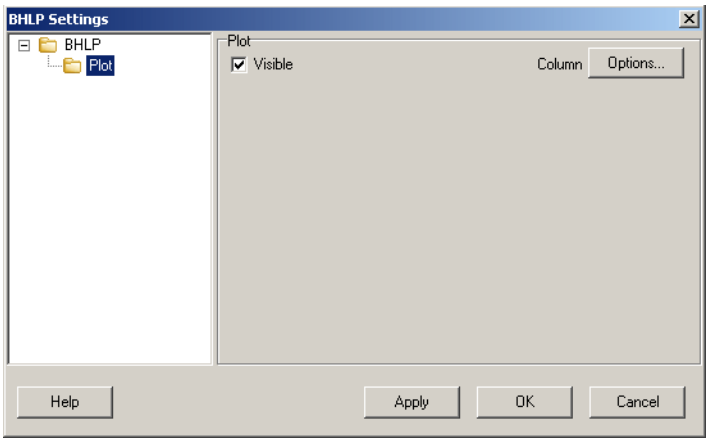
You can add several plot series - depth and interval - to one plot column. All lines and shapes will be drawn in the default color and will be semi-transparent, so that when they overlay each other, every plot is visible.

Be careful, however, with displaying plots with vastly different scales on the same plot column. The plots will be shown on the same scale, relative to each other, so it may appear that one of the plots is hidden from view.

Settings

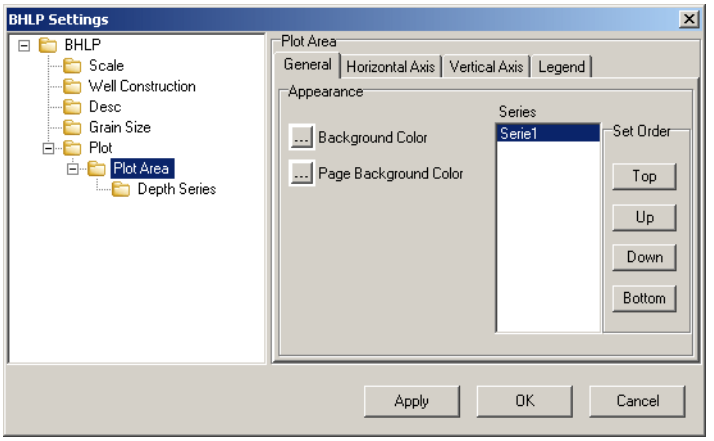
The **Plot** column settings are shown in the following screenshots. As mentioned previously, the settings can be adjusted by right-clicking anywhere in the BHLP window and selecting **Properties**, or right-clicking on the **Design** node and selecting **Show Settings**, then selecting the **Plot** node from the **BHLP Settings** window.

The settings for the **Plot** node are shown in the following screenshot.

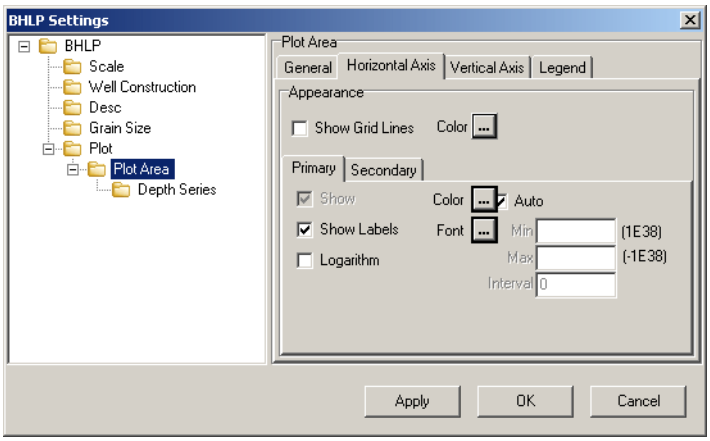


The **Plot** frame allows you to show/hide the column using the **Visible** checkbox. You can modify the general column settings by clicking the **Options...** button (see “Column Options” on page 447)

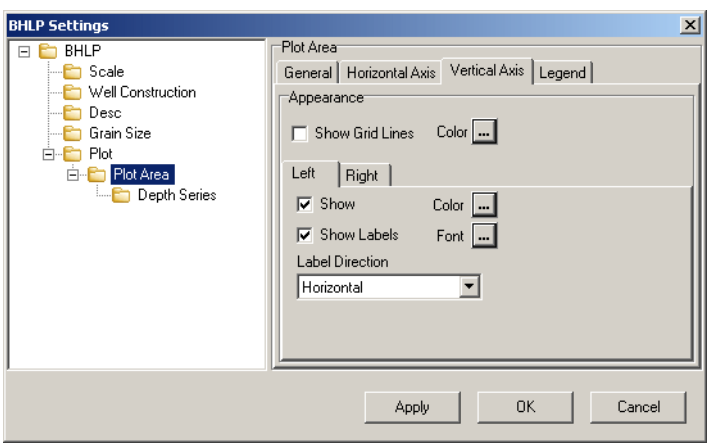
The Settings for the **Plot Area** sub-node are shown in the following screenshots:



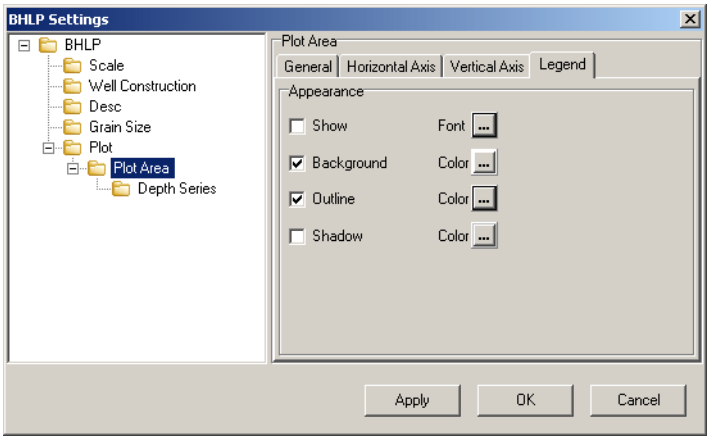
In the **General** tab, specify the background color and page background color. Under the series frame, you can set the order of the plots (to have one plot above/below the other).



In the Horizontal Axis tab (shown above), you can modify the axis appearance and scale settings. For both the **Primary** and **Secondary Scales** there are settings for Normal or **Log,** as well as showing the gridlines and defining the color. Finally, you can define the axis range for each scale; accept the default **Auto** option, in which case, the data min and max will be read, and used as the min and max for the axis. Or, de-select this option and enter user-defined **Min**, **Max**, and **Interval** values.

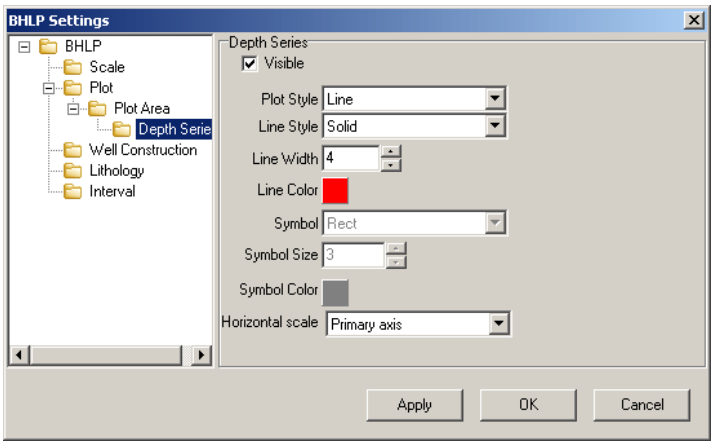


In the Vertical Axis tab (shown above), you can modify the appearance settings of the vertical axis. For both the Left and Right axis, axis labels can be enabled/disabled by selecting the **Show Labels** checkbox. You can also change the label color by clicking on the **Color** box, and change the font by clicking on the **Font** box. **Label Direction** can be modified by making a selection from the combo box; choose from horizontal or vertical direction.



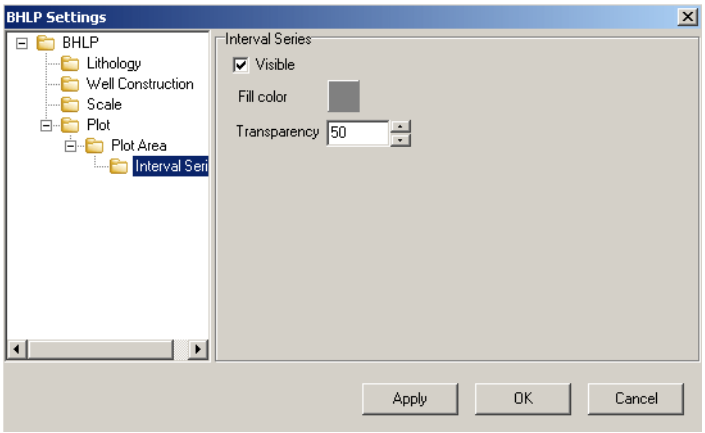
Under the Legend tab, there are settings that control the **Visibility,** and the **Background** and **Outline** visibility and color.

The specific settings for the **Depth** sub-node are shown in the following screenshot:



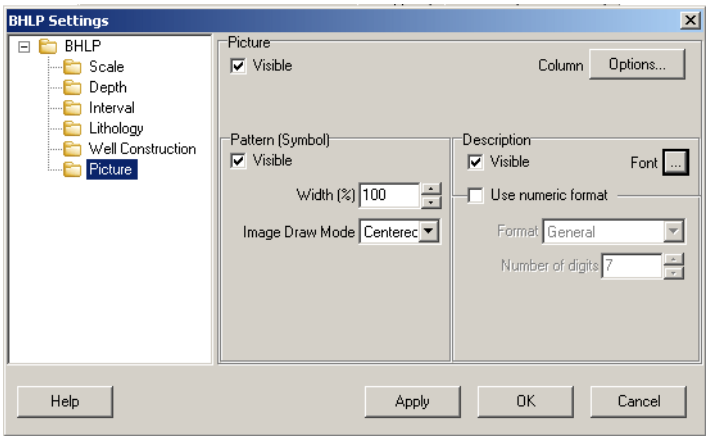
Plot, **Line**, and **Symbol** options can be configured, and the Depth Series can be shown/hidden using the **Visible** checkbox. You can also set the **Horizontal Scale** for the plot series; choose from Primary or Secondary axis.

The specific settings for the **Interval** sub-node are shown in the following screenshot:



The **Interval Series** can be shown/hidden, and the **Fill color** and **Transparency** can be set.

12.2.7 Picture Column



The **Picture** column settings are shown in the above screenshot. As mentioned previously, the settings can be adjusted by right-clicking anywhere in the BHLP window and selecting **Properties**, or right-clicking on the **Design** node and selecting **Show Settings**, then selecting the **Picture** node from the **BHLP Settings** window.

The **Picture** frame allows you to show/hide the column using the **Visible** checkbox. You can also set the general column settings by clicking the **Options..** button (see page 447).

The **Pattern (Symbol)** frame allows you to show/hide the image pattern, modify the **Width**, and change the **Image Draw Mode**.

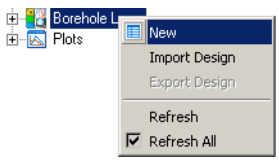
The **Description** frame allows you to show/hide the description, and modify the **Text Font**. If you choose to display numeric data, select the **Use numeric format** check box. Please refer to the *Depth-Point Based Column (page 450)* section for more information on this option.

12.3 Designing a Borehole Log Plot

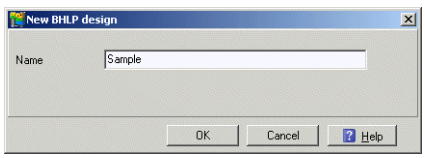
In HydroGeo Analyst, only the borehole log plot templates are stored. This is done so that the data for the plots will not be duplicated. HydroGeo Analyst reads the necessary data for a borehole log plot from the database when displaying the plot.

To design a borehole log plot template, select at least one borehole in the **Station List** grid. Alternately, activating a Station Group suffices for this purpose, as all boreholes are assumed selected if there is no specific selection made in the grid.

Once a station group containing the desired boreholes is opened, and at least one borehole is selected, right-click on the **Borehole Logs** node on the **Project Browser**. Select the **New** pop-up menu option, as shown in the following screenshot, to design a new template.

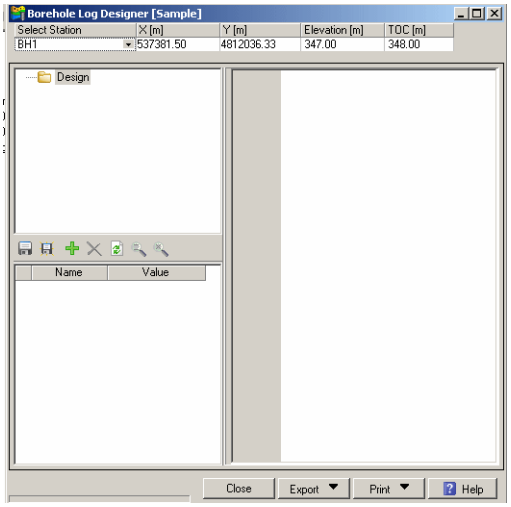


In the **New BHLP Design** window that appears, enter a name for the new borehole log design.



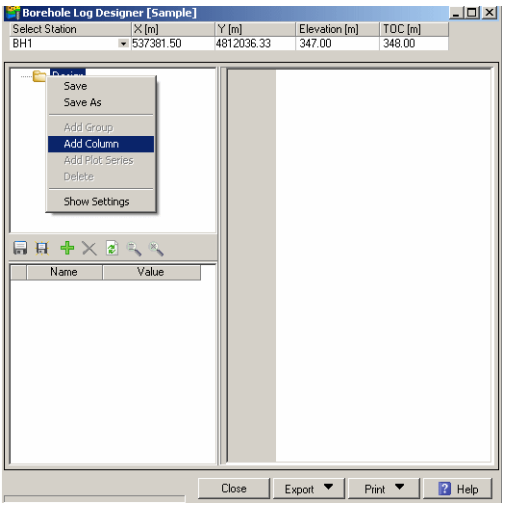
Note that the background color of the text box turns red if you type the name of an existing borehole log design, indicating that you cannot have two BHLP's with the same name. Modify your new template name slightly, and the **[OK]** button will be re-enabled.

In the **Borehole Log Designer** window that opens, the borehole(s) you have selected previously will be made available in the **Select Station** combo box at the top-left of the borehole log designer. You can now add the desired elements to the empty BHLP template, as shown in the following screenshot.



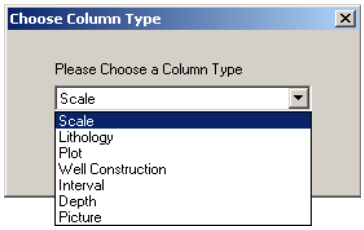
12.3.1 Adding Lithology Column

To add a column to the BHLP, right-click on the **Design** node in the tree view, and select the **Add column** menu option, or click the (Add) button in the toolbar.

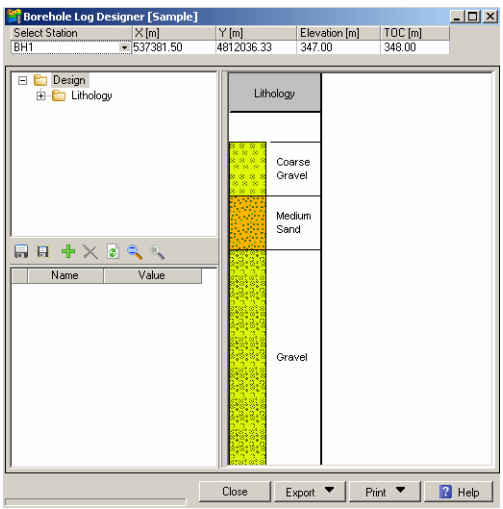


Select Column Type

Select the desired column type from the pop-up menu, and press **[OK]** button.

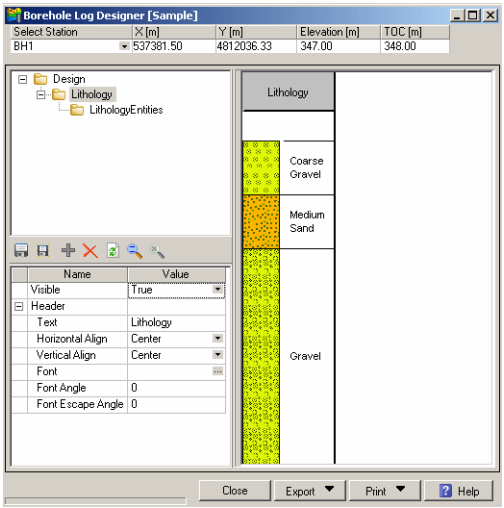


A node identifying the column will be added to the tree view under the Design node. For some columns, such as Lithology and Well Construction, the BHLP attempts to obtain data for the borehole that is currently selected in the combo box, and displays a preview in the viewer. An example is shown below for a new Lithology column:



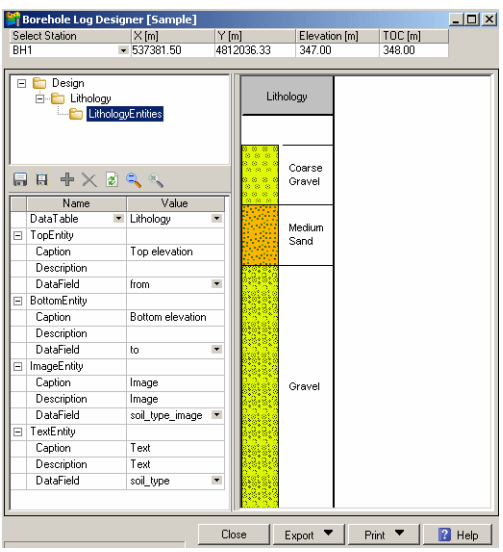
Edit Column Properties

Column properties (Entities) can be set by expanding the **Design** node and clicking on the sub-node to be updated. For example, to modify a Lithology column, expand the Design node, and select **Lithology** from the tree, as shown in the following screenshot:



Column properties are divided into two groups. The first group of properties is common to all columns, and can be accessed by clicking on the main node for that column. These properties include the **Visible** option, and **Header** related settings.

The next group of properties can be accessed by clicking on the sub-node of the column node. This group of properties varies between column types, and generally provides the controls through which data to be displayed on the column will be selected. For our Lithology example, select **Lithology Entities** from the tree as shown in the following screenshot:

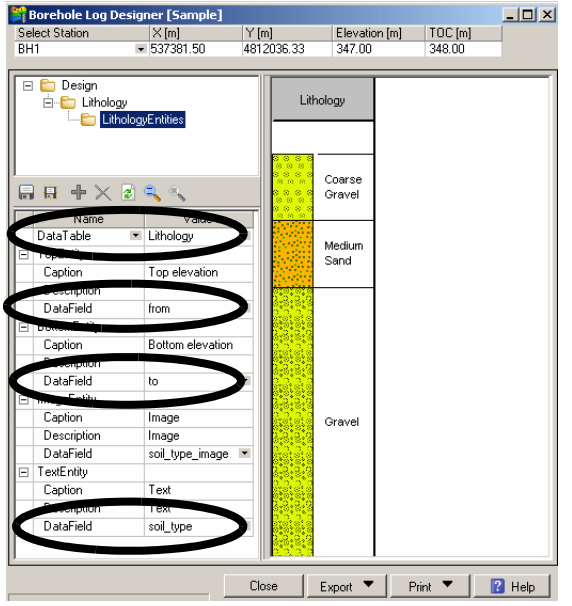


In some cases, the BHLP may not be able to identify the default data source for the selected column type, and as a result there may not be a preview. In this event, you can

manually select the data source or query results for the column using the **Data Table/ Queries** property. In the case of Lithology, select the **Lithology Entities** node, as shown in the previous screenshot.

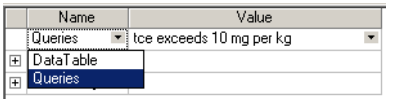
Specify Data Source

First select if you want to use a **Data table** or a **Query** as the Data Source. Then, choose the respective table or data query from the list provided in the combo box next to this property, as indicated in the following screenshot. All fields from the selected table or query will be available for mapping to the required data fields in the column. Update each **Data Field** as necessary. The Data Fields required for a Lithology column are circled in the following figure.



Note: The depth-point and depth-interval information (from, to fields) are depths, not elevations. Therefore, the BHLP requires that data be entered as “depth to” and not an elevation above sea level or a benchmark.

Note: When **Queries** are selected for the data source, all Queries in your HGA project will be listed in the corresponding pull-down menu.

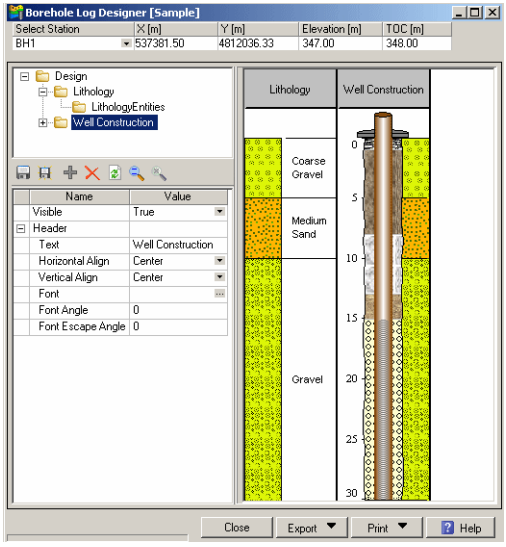


Using a Query instead of a Data Table provides more flexibility in the type of information that can be added to a BHLP. For more information on developing a Query to use in a BHLP, please see Chapter 7: Queries. Please be aware that not all queries will be appropriate for use in a BHLP, and that in some cases (e.g. Lithology) a query cannot replace a data table. As well, queries cannot be used if images are to be added.

NOTE: When a **Query** returns more than 1 record for a selected station (e.g. time-varying concentrations, at a single borehole, over various depths), the BHLP will automatically use the first result value in the query. If using another value is desired, then the Data Query should be modified with the appropriate conditions.

12.3.2 Add Well Construction Column

Next, add another column type to the BHLP by right-clicking on the **Design** node and selecting **Add Column**. In this example, Well Construction has been added, to produce the design shown in the following screenshot:

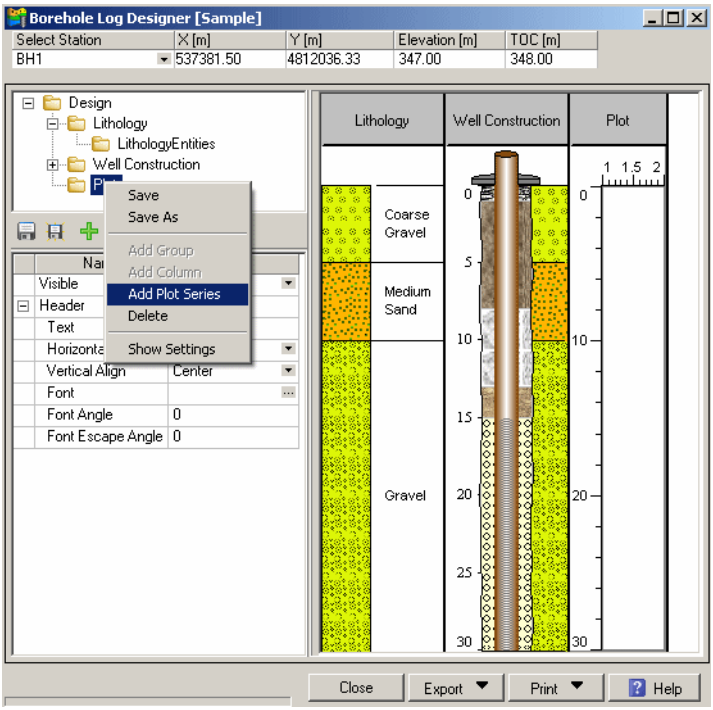


12.3.3 Add Plot Columns

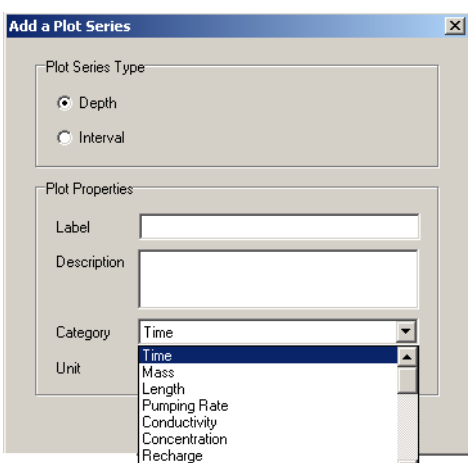
To add a plot column to your BHLP, right-click on the **Design** node, and add a **Plot** column. Once the Plot column has been added, the Plot Series options must be defined.

Add Plot Series

To add a plot-series, right-click on the **Plot** column in the Design tree. Alternately, you can click on the (Add) button on toolbar after having highlighted **Plot** in the Design tree. Select the **Add Plot Series** option, as shown in the following screenshot.

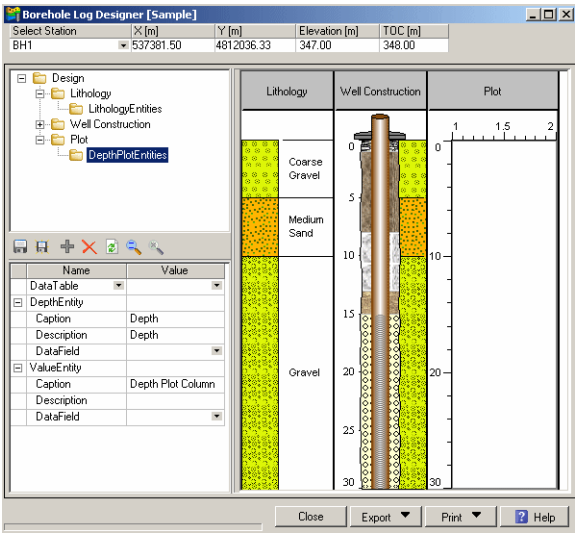


The **Add a Plot Series** window will open, as shown in the following screenshot.



Choose the **Plot Series Type,** enter **Plot Properties** as required, then click **[OK]** to create the plot column.

Next, the Plot Entities must be defined. Click on the **Plot Entities** sub-node to expand the Entities options, as shown in the following figure.



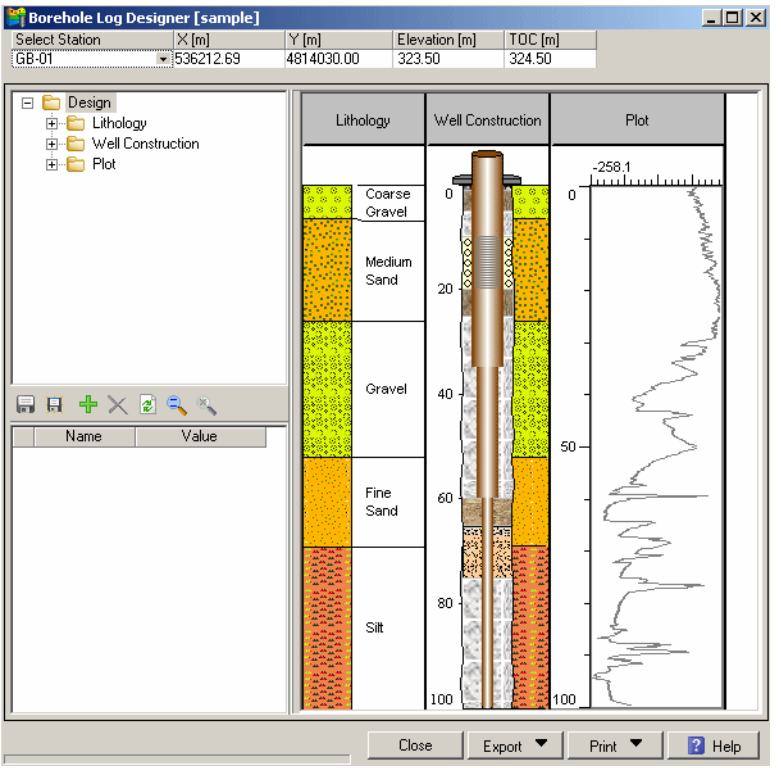
For a **Depth Plot**, you must define the following:

- A Data Source; this may originate from a **Data Table** or a **Data Query**. Select the format you wish to use, then select the respective table or query from the combo-box
- A **Data Field** for the **DepthEntity** (select the field containing depth values from the pull-down menu)
- A **Data Field** for the **ValueEntity** (select the field containing the values you want to plot from the pull-down menu)

For an **Interval Plot** column, you must define the following:

- A Data Source; this may originate from a **Data Table** or a **Data Query**. Select the format you wish to use, then select the respective table or query from the combo-box
- A **Data Field** for the **TopEntity** (select the “from” field of the data table from the pull-down menu)
- A **Data Field** for the **BottomEntity** (select the “to” field of the data table from the pull-down menu)
- A **Data Field** for the **ValueEntity** (select the field containing the values you want to plot from the pull-down menu)

Once you have entered all required information, click the (Refresh) button to see the data on the plot column. An example is shown in the following screenshot.



12.3.4 Re-order BHLP Columns

If you have added several columns to your borehole log plot, and you would like to change the order in which they appear, you can simply click on one of the sub-nodes under the **Design** node in the tree to highlight it, then click-and-drag the folder to a new position in the folder list. The BHLP will be re-organized to reflect the order of the sub-nodes under the Design node.

12.4 Saving the Borehole Log Plot

Once the desired BHLP design is obtained, there are several saving and exporting options available.

- The BHLP template can be saved, to be recalled later on
- The BHLP image itself may be exported to a Report or an external file
- The BHLP image may be printed

12.4.1 Saving a borehole log plot design template

To save a BHLP template:

- Click on the (Save) button on the BHLP designer toolbar.

To save a copy of a BHLP template with a new name,

- Click on the (Save As) button on the BHLP designer toolbar.

12.4.2 Exporting a borehole log plot design template

It is possible to export the design and data composing a borehole log plot. This is helpful if the user wants to create an XML file from the database. To do so, click on the **Export** button at the bottom of the Designer window, and select from one of the export options, as shown below.

You can either **Export the Current Borehole**, or **Export all boreholes** in your project, using the current BHLP template. The exported file will be saved in .XML format.

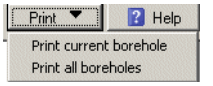
Note: To export a BHLP report to a file, please see below.

12.5 Borehole Log Reports: Printing and Exporting

12.5.1 Generating a borehole log report

A BHLP report may be generated from within the BHLP designer, and either printed or saved to an external file.

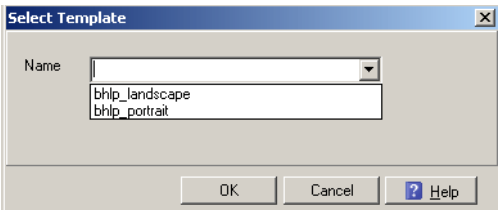
With the **Borehole Log Designer** window open, click on the **Print** button at the bottom of the BHLP designer window, and select from one of the print options, as shown in the following screenshot.



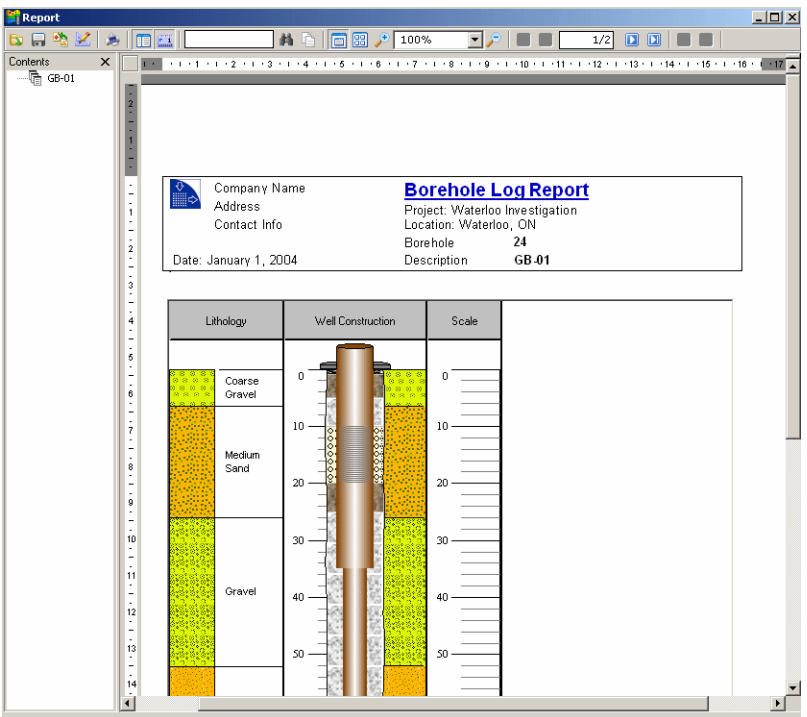
NOTE: If you select **Print all boreholes**, a report will be generated for each station in the current selection; please be aware that this may take some time. If you want to print a BHLP for just the selected station, use the **Print current borehole**

option.

You will be prompted to **Select a Template** for generating your report, as shown in the following screenshot. You can either select from the existing templates, or leave the selection blank and create a new report template yourself.



An example report (loaded with the **bhlp-portrait** template) is shown in the following figure:



If you have set a **Print Scale factor** (please see “BHLP Default Settings” on page 446 for more information), by default the scale will appear in the lower-left corner of the BHLP report. Alternately, you can use the Report Designer (please see Chapter 11: The Report Editor) to add a **label** named “Scale” in your header/footer information. The default label will automatically be removed if a label named “Scale” is added.

The BHLP Report may be printed directly by clicking on the (Print) button, saved to a report archive file by clicking on the (Save) button, or exported to one of several file formats, including .RTF, .PDF, .HTML, .XLS, and .TIF, by clicking the (Export) button.

If you would like to modify an existing report template, or if you did not select an existing template and are creating your own report, you can modify the report design to suit your needs.For more details on designing and modifying a report, please see Chapter 11: The Report Editor.

13

Quality Control

When collecting, analyzing, and interpreting environmental data, Quality Control (QC) can come in many forms and fashions. HydroGeo Analyst supports a Lab Quality Control component, that allows users to verify the accuracy of the analysis results reported by a laboratory.

As part of a data collection process, duplicate samples, blank (control) samples, and spiked samples are added to sample sets; these samples are sent to a laboratory, along with the original field samples, to be analyzed in a controlled environment, using constant techniques, instruments, and personnel. The objective is to identify any sources of contamination that may originate from the lab analysis, and provide some assurance to the client, that the data is valid, and representative of your site conditions.

HydroGeo Analyst has integrated a Lab Quality Analysis component that allows users to:

- Define one or more lab quality assessment templates
- Analyze Duplicate, Spiked and Blank samples
    - Compare Relative Percent Difference and Coefficient of Variation for Duplicate samples (for more details, see “Check Duplicates Settings” on page 489).
    - Analyze Percent Recovery for Spiked samples (for more details, see “Check Spiked Settings” on page 490).
    - Compare Blank samples to method detection limits (for more details, see see “Check Blanks Settings” on page 491).
- Execute a Quality analysis on a selected dataset
- Display and retrieve assessment results; records not meeting assessment criteria will be highlighted
- Save assessment results to a MS Excel spreadsheet

This chapter is divided into the following sections, to help you prepare your data, and execute a QC Analysis:

- “Preparing Your Data for QC Analysis” on page 486
- “Define A New Lab Quality Template” on page 488
- “Applying a Lab Quality Template” on page 492
- “Generate QC Results” on page 493

13.1 Preparing Your Data for QC Analysis

Your QC Blank, duplicate, and spiked samples should be entered in the same table and fields as your original samples.

If a Duplicate sample was collected at an existing station, then create a new sample ID (Sys_sample_code), and assign the appropriate Quality Code (D). You must also define a common batch ID for duplicates to indicate that they belong together. If you want to compare the duplicate to its original sample, you must add the appropriate Original Sample Quality Code (O), to each original sample.

If a Blank sample was collected, it can be added as a new station and sample, or as a new sample, to an existing station. Create a new sample ID (Sys_sample_code), and assign the appropriate Quality Code (B).

For Spiked samples, you must add two types of samples codes and results:

- The first will be a sample that contains the known spiked concentration, for each parameter. Create a new sample ID (Sys_sample_code), and assign the appropriate Quality Code, ST (for Theoretical Spiked concentration). Create a new sample for every spiked sample and enter the amount of constituent that has been added for every spiked parameter.
- Next, add the analyzed spiked sample as a new sample. Create a new sample ID (Sys_sample_code), and assign the appropriate Quality Code, SM (for Measured Spiked concentration). Create a new sample for every spiked sample and enter the measure amount of constituent that was recovered, for every spiked parameter.

Both the measured sample and the sample holding the theoretical concentrations should be assigned a common batch # (Batch ID), which relates the samples to each other.

Defining Quality Codes for Data

When importing/adding sample data, quality codes need to be added to indicate the type of sample, in order to be used in a Lab Quality Analysis. The following are the codes required by HGA:

Sample Type	Quality Code
Duplicate Original	O
Duplicate Measured	D
Spiked Theoretical	ST
Spiked Measured	SM

Sample Type	Quality Code
Blank measured	B

Using the Template Manager, you can create a field that will store the quality codes. This field may be added to any table, but typically it is found in the Chem_sample table, with the Sys_sample_code.

These quality codes are saved in the file:
...\Program Files\HGAnalyst\Whi.QualityAC.dll.config

If necessary, the codes may be changed to reflect the codes used in your data. Simply use a text editor to open the .config file, and modify the quality codes under the section: <QualityCodes>.

13.1.1 Data Requirements

Quality Control starts with a data set; before you can apply a quality control template, you must generate a data set, by building and executing a data query with the Query Builder. The data query should contain the data set your are interested in analyzing, along with the fields required by the Quality Control component.

The following are required fields for the Lab Quality validation, and as such, must be fields that are present in your data query:

- Station ID: located in the Station table
- Sample ID: also referred to as the Sys_sample_code, this is typically found in the Monitoring Event > Chem Sample table, or the Soil Sampling > Soil Sample table.
- Batch Identifiers: Samples that are prepared and/or analyzed together with the same process and personnel, using the same lot(s) of reagents, within a specified time period, should be assigned the same Batch ID. Both the measured sample and the sample holding the theoretical concentrations should be assigned a common batch number, which relates the samples to each other.
- Detection Limit: Method detection limit, typically found in the Chemistry_Results or Soil_Chemistry table.
- Parameter Name: contains the parameter being analyzed; typically found in the Chemistry_Results or Soil_Chemistry table with the results
- Parameter Identification Information: contains meta data about the parameter; typically found in the same table as the parameter name
- Parameter Values: The measured or observed value for the selected chemical or parameter. Typically found in the Chemistry_Results or Soil_Chemistry

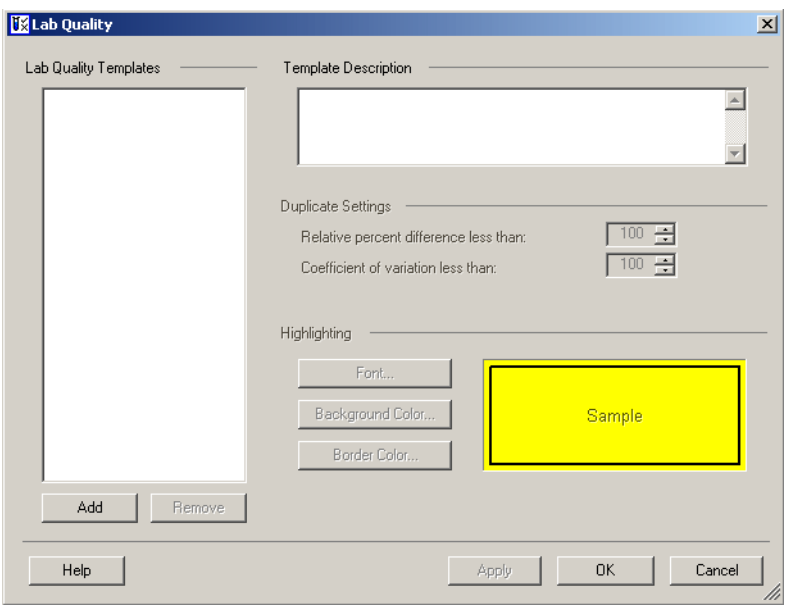
table
- Quality Code Identifiers: Used to identify the sample type. Typically found with the Sample ID, in the Monitoring Event > Chem Sample table, or the Soil Sampling > Soil Sample table. see “Defining Quality Codes for Data” on page 486 for more details

The following fields are not required, but are helpful for easily identifying samples in the results page:

- Station Name: located in the Station table
- Sample Name: this is typically found in the Monitoring Event > Chem Sample table, or the Soil Sampling > Soil Sample table.
- Sample Date
- Units
- Unit conversion factors

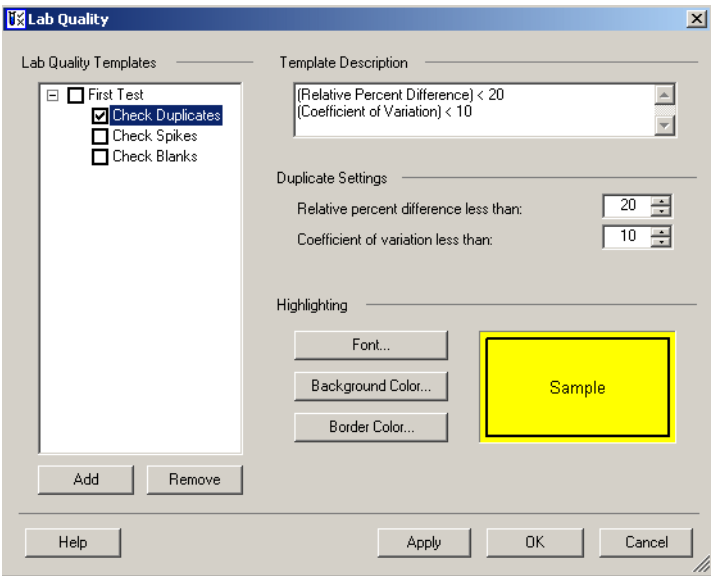
13.2 Define A New Lab Quality Template

To create a new lab quality analysis template, click **Tools > Quality Control** from the Main Menu, then select the **Manage Lab QC Templates** option. The **Lab Quality** window will open, as shown in the following figure:



To create a new template, click the **[Add]** button, and enter a name for the template. The newly created template will then appear in the **Lab Quality Templates** list. To configure your template, click on the **[+]** to expand the template tree. As shown in the

following example screenshot, the three Check types (**Duplicate**, **Spikes**, and **Blanks**) will be listed. To activate a Check type, click in the checkbox beside it.

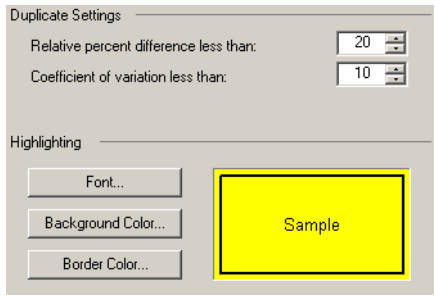


The **Template Description** field is filled in by default with a verbal description of the Settings used for the template. You can modify the Template Description with any text you would like to use by simply typing over the existing text.

Each Check type has its own Settings, which can be adjusted by clicking on the Check type to highlight it. The Settings will then appear to the right. Settings for each Check type are described in the following sections.

13.2.1 Check Duplicates Settings

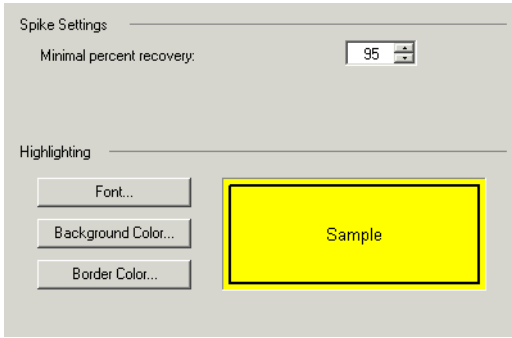
A field duplicate is a QC sample which is used to determine the precision associated with all or part of the sample collection and measurement process. Field duplicates are two independent samples which are collected, as nearly as possible, from the same point in space and time. The two field duplicate samples are collected from the same source, using the same type of sampling equipment. Ideally, analyte concentrations in the duplicate sample should be identical, or very close, to the original sample to which it is being compared. The following settings are available:



- **Relative percent difference less than**: This criteria is used to compare how close the result from a duplicate sample (D) is to the true, original field sample (O). It is expressed as either a positive difference (the sample result is higher than the true value) or negative difference (the sample result is lower than the true value). When used with duplicate samples, the Relative Percent Difference measures precision - the lower the value, the more precise the results must be to be considered acceptable. It can also measure accuracy, when one of your results is the true value (such as the quality control lab results for a split sample), or the actual concentration of a known or unknown sample.
- **Coefficient of Variation (CV) less than**: The standard deviation as a percentage of the average. The CV is a unitless quantity indicating the variability around the mean, in relation to the size of the mean. When used with duplicate samples, the CV measures precision - the lower the value, the more precise the results.
- **Highlighting**: If a record is identified as not meeting the Template criteria specified above, it will be highlighted according to the settings entered in this frame. By default, the record's **Background Color** will be changed to yellow. However, the user has the option to modify the **Font**, the **Background Color**, and the **Border Color** of the record by clicking on the appropriate button(s).

13.2.2 Check Spiked Settings

A matrix spike is an aliquot of sample that is spiked with a known concentration of target analyte(s) prior to sample preparation. Ideally, there should be 100% recovery of the spiked concentration (or very close to this). The following settings are available.



- **Minimal Percent Recovery**: The percentage of the substance added to a spiked sample that is detected. It is the difference between the concentration detected in the spiked sample and that detected in the un-spiked sample, divided by the concentration of the substance added to the spiked sample. Minimal Percent Recovery measures accuracy - the higher the percent recovery, the greater the accuracy must be to be considered acceptable.

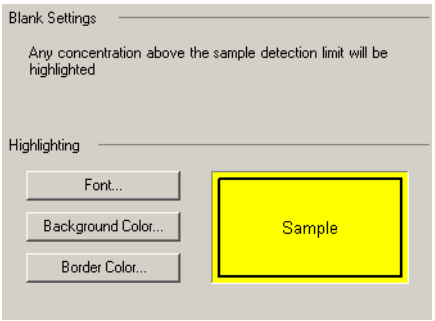
  NOTE: The analysis assumes that the sample that is being spiked is a blank, and does not contain any detectable concentrations of any of the contaminants. You may not use a field original sample for a spiked sample analysis.

- **Highlighting**: The options are the same as described in “Check Duplicates Settings” on page 489.

13.2.3 Check Blanks Settings

A blank is a quality control sample used to detect and identify contaminants introduced to samples during the measurement process. A laboratory blank is an analyte-free matrix that is carried through all or part of the analytical process for identifying contamination introduced during analysis. Types of laboratory blanks include method blanks (carried through the entire preparation and analysis sequence), calibration blanks (matrix-matched reagent water used for calibration), and storage blanks (placed in sample storage areas). In the field, an analyte-free matrix is carried through a portion of the field process to identify contamination introduced during field or transportation operations. Types of blanks associated with the field are trip blanks (these accompany samples through the transportation process), equipment rinsates (collected after decontamination), and field blanks (collected on-site during the sampling event).

Ideally, analysis of the blank samples should return no detectable concentrations of any of the analytes; i.e. concentrations are below the method detection limit (MDL).



- The detection limit for contaminants can be specified in HGA, and must be added to your data query.
- **Highlighting**: The options are the same as described in “Check Duplicates Settings” on page 489.

Once you have defined the settings for your analysis Template, you can create another template by clicking the **[Add]** button, delete an existing template by clicking the **[Remove]** button, or accept/reject your changes and return to the HGA main program window.

You are now ready to apply the lab quality template to your data.

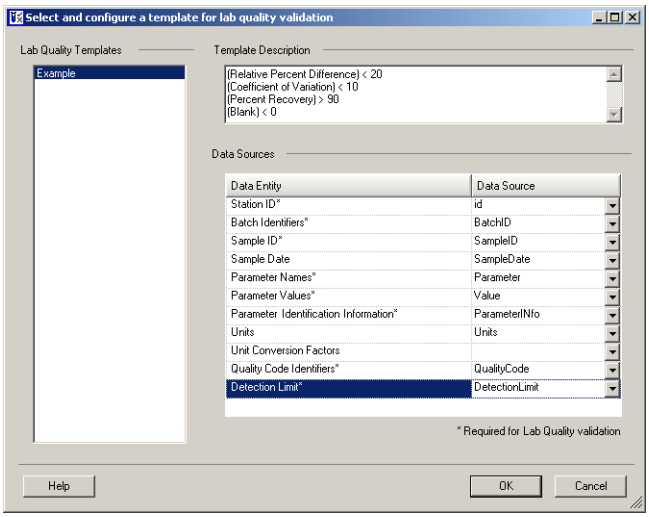
13.3 Applying a Lab Quality Template

NOTE: An example of a Lab Quality Data query is available in the HGA Demo project; select the **QC_Lab_Analysis** query in the **Queries** node, and feel free to follow along with the instructions below.

To apply a Lab Quality Template, follow the instructions below:

- Select and highlight the appropriate Data Query from the **Queries** node in the HGA Browser.
- From the main menu, click **Tools > Quality Control** and select the **Perform Lab QC Assessment** option; the following dialog will appear:

.



From the **Select and configure a template window** select from the list of **Lab Quality Templates.**

Once a template has been selected, the Template Description field will be completed with the description entered when the template was created. The next step is to map the fields in your data query, to the fields required by the QC component.

13.3.1 Mapping Fields

In the **Data Source** frame, the **Data Entity** must be matched to the **Data Source** for all required fields; required fields are marked with a "*", and are also listed in previous section. In most cases, HGA will be able to automatically detect and map the fields, however if you have created custom fields, or renamed existing fields in your database structure, you may need to browse through the list and select the appropriate **Data Source** in your project (using the pull-down menus) that corresponds with a **Data Entity**.

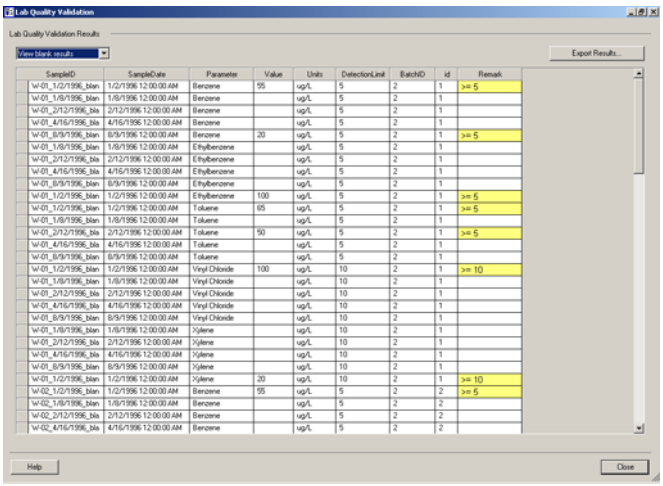
NOTE: A field in your query must be mapped to each of the required fields, as listed above; see the section "Data Requirements" on page 487 for more details.

13.4 Generate QC Results

Once all required fields have been matched in the template, the **[OK]** button will become active. Clicking **[OK]** will run the Lab Quality Analysis, and once completed the **Lab Quality Validation** window will appear. If your template included more than one Check Type, you can use the pull-down menu in the upper left corner, to switch

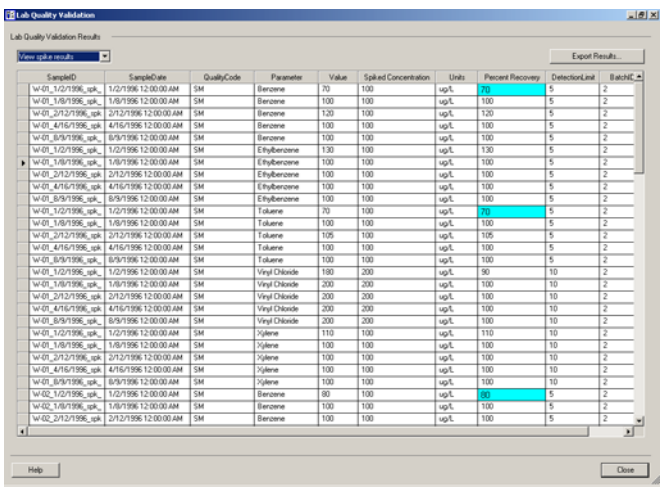
between each type, and the **Lab Quality Validation Results** table will automatically update.

The results for Blanks analysis are displayed in the screenshot below:



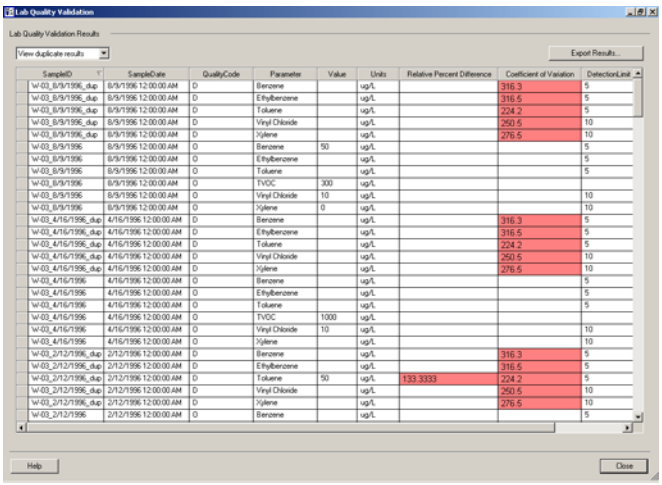
Records that exceed the method detection limit will be highlighted with the color and font specified in the Template.

The results for Spiked sample analysis are displayed below.



This analysis compares the spiked measured (SM) sample to the spiked theoretical (ST) sample, for each parameter with available spiked values, and calculates the Percent Recovery. Records that are less than the specified Percent Recovery will be highlighted with the color and font specified in the Template.

The results for Duplicates analysis are displayed below.



This analysis compares all concentrations measured in the duplicate measured (D) sample to its duplicate original (O) sample, and calculates the Percent Difference and the CV. Records that exceed the specified Percent Difference, or exceed the specified Coefficient of Variation will be highlighted with the color and font specified in the Template.

13.4.1 Export Quality Control Analysis Results

To export the results of your Lab Quality Analysis to a MS Excel spreadsheet, click the **[Export Results]** button, and enter a filename for your exported data.

14

Plotting

The plotting component in HydroGeo Analyst allows users to create hydrochemistry and statistical plots of data stored in the HydroGeo Analyst database. The plotting provides the following features:

- Create Time Series X-Y plots using data from data queries.
- Display X-Y plots as a line or bar chart.
- Add legends and data marker labels to plots
- Add best fit, trend, formula, or statistical lines to the plot
- Interact with plots, and display multiple plot windows in the viewer window simultaneously
- Display non-detect, uncertainty, or detection limits on the plot, as lines or symbols
- Display one or more water quality standard values, as a line or symbol, for quick detection of samples that exceed the standards
- Define data series ranges, and modify display properties for different data ranges (e.g. define a data range where the data exceeds the water quality standard values, and assign unique symbol, line, and display properties for this data)
- Select fields for plot grouping or data series grouping
- Modify display properties, including axis, labels, symbols, legends, and intervals
- Print plots to a single or multiple pages
- Save plot settings as templates for re-use
- Export plots to graphics format
- Copy plots to Windows clipboard

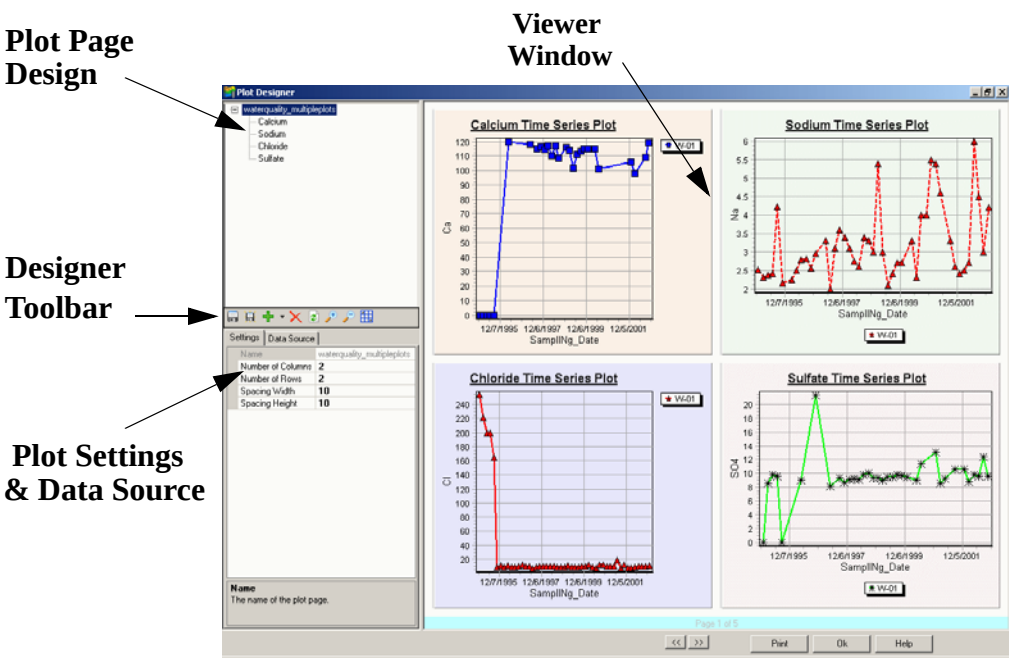
14.1 About the Interface

Once you have created and selected a data query, you may create a plot with the data set. The plot component may be launched from HydroGeo Analyst in several ways:

- To create a new Plot Page Design, *right*-click on the **Plots** node (on the Project Browser) and select **New** from the pop-up menu
- Existing plots can be opened from the **Plots** node in the Project Browser by either double-clicking on the desired plot in the available list, or by *right*-clicking and selecting the **Open** pop-up menu option.

NOTE: A data query containing the required fields (see below) must be selected in order to launch the plots mode from the HydroGeo Analyst main interface.

A typical plot window is shown in the following figure.



The plot window contains the following items:

- **Plot Page Design Tree**: A list of all available plot page designs, plots, and series such as Lines and Standards
- **Designer Toolbar**: Toolbar buttons used for modifying the plot design
- **Plot Settings and Data Source**: Contains the settings for the selected entity, and data mappings
- **Viewer Window**: Contains a real time view of the plot page design

14.1.1 Description of Designer Toolbar Items

The plot designer toolbar provides the controls for designing the plot page. The following buttons are available.

Save button saves the current plot design

Save As button saves the current plot design as a new name

Add button provides two options: Add Plot will prompt you to select a template to be used; Add Default Plot will create a new plot using the default plot template

Delete button deletes the selected plot or line series

Refresh button refreshes the design with new settings or data

Zoom in button allows you to zoom into the selected plot page; to zoom in on selected plot data within an individual plot, refer to the section “Zoom” on page 500 below.

Zoom out button returns to the original zoom view

Fit to Page button fits all plots to the current viewer window size

At the bottom of the window, you will find the following buttons:

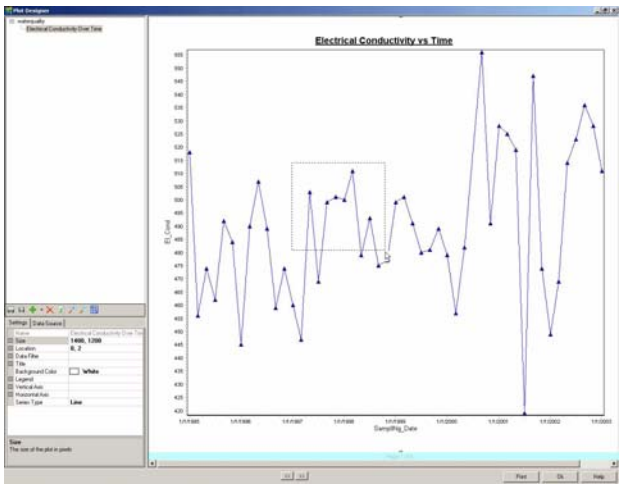
The function of these buttons, from left to right, is:

Previous Page: scroll to the previous page in the plot design

Next Page: scroll to the next page in the plot design

Zoom

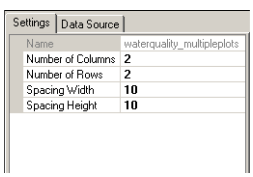
To zoom in on plot data in an individual plot, use the mouse cursor to draw box around the desired data; a sample is shown in the screen shot below:



To zoom out to the original extents, right-mouse click on the plot area, and select **Zoom Out** from the menu.

14.1.2 Viewer Window Settings

Under the **Settings** tab, you can define the settings for the plot page design:



Name controls the name of the selected plot series; this is read-only, and cannot be modified.

The plotting component supports display and manipulation of multiple plot windows in the viewer window.

Number of columns controls how many columns will be displayed in the viewing window for displaying plots.

Number of rows controls how many rows will be displayed in the viewing window for displaying plots.

For example, 2 columns X 2 rows means that 4 plots may be displayed simultaneously in the viewer window.

Spacing width controls the amount of space between each plot, in the horizontal direction.

Spacing height controls the amount of space between each plot, in the vertical direction.

14.2 Adding Plots

The data source for the plots must originate from a Data Query; before you create a plot, you must build and execute a data query using the Query Builder. The data query should contain the data set your are interested in analyzing, along with the fields for a time series plot.

The following are required fields for the Time Series plots, and as such, must be present in your data query:

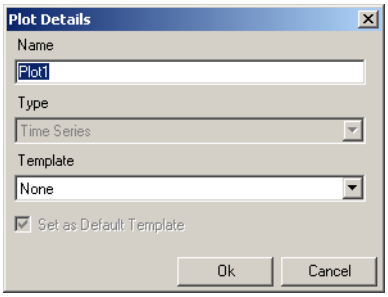
- Sample Date or Time
- Value for the parameter of interest (e.g. water level, chemical concentrations, temperature, pH, conductivity, etc.)

The following fields are not required, but are recommended for plot and series grouping, and to take advantage of additional plot options:

- Station ID
- Station Name
- Chemical (Parameter) name
- Measured parameter units
- Non detect (ND) factor
- Method detection limit (MDL)
- Uncertainly factor
- Water quality standard

14.2.1 Add Plot

To add a new plot to the design, click the (Add) button in the toolbar, or *right*-click on the **Plot Page Design** node in the tree view, and select the **Add plot** menu option. The following **Add plot** dialog will appear:



In the **Name** field enter the name of the plot.

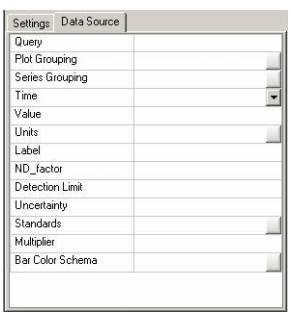
The **Type** combo box contains the supported plot type; currently only Time-Series scatter plots are supported, however future versions of HGA will support numerous types of Geochemistry and Statistical plots.

In the **Template** combo box, select the desired plot template that should be applied to the new plot. The plot template contains numerous pre-defined settings for axis, data series, style settings, etc. If you want to re-use the same template again in the future, select the **Set as the default template** check box. For details on creating plot templates, see “Saving Plot as Template” on page 515.

Click **[OK]** when you are finished, to display the new plot in the viewer window. The next step is to map the fields.

14.2.2 Field Mappings

Under the **Data Source** tab, you can define the field mappings for the plot, as shown in the screenshot below:



Query: select the data source for the plot from the combo box; currently the data must come from data queries.

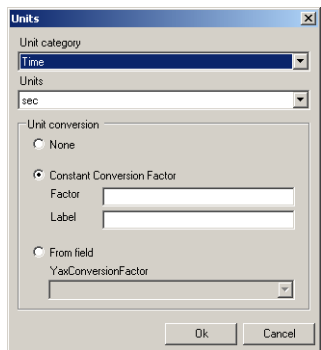
Plot Grouping: specify a field to be used for grouping plots

Series Grouping: specify a field to be used for grouping series; at least one field must be selected for grouping the plot series.

Time Axis: specify a field to be used for the Time (X) axis. This should be the date field from your query.

Value Axis: specify a field to be used for the Value (Y) axis. This will be observed result value for the parameter(s) of interest.

Units: loads the following dialog, allowing you to make unit conversions:



Select the unit category, then the units from this category. If the units' categories are not compatible (for instance Time and Length) then the buttons are disabled.

You may also select a field to be used for the unit conversion, or create constant conversion factor; in this case, enter the factor, and an appropriate field.

The units conversion component implements full SI units including temperature, electric current and luminous intensity.

Label: select a field to be used for the symbol label

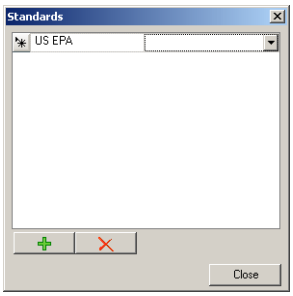
The next two fields are used to control non-detect results. When the query returns null records for the result value, the method detection limit (if available and if selected) can be displayed on the plot. Optionally, the method detection limit multiplied by the non-detect factor (**ND_Factor**) can be used instead of the method detection limit. For example if an ND_Factor of 0.5 is provided, and a column containing method detection limit values is provided, then the plot will display the method **Detection Limit** (DL) value multiplied by 0.5 (the **ND_Factor**). If ND_Factor is left empty, then the DL will be displayed.

ND_Factor: specify a field that contains the factor for non-detects.

Detection Limit: select a field that contains the detection limit value

Uncertainty: select a field that contains a value for the uncertainty for the plotted series. This will plot uncertainty bars directly on the plot

Standard: This option allows you to display water quality standards as a plot series on the plot. This is useful for quickly identifying which values exceed the standard. When you load the options for standards, the following dialog will appear:

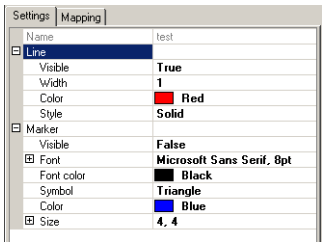


Click on the **[Add]** button to add a standard value and select a field that contains the standard value

Click on the **[Delete]** button to remove existing list items from the list.

When you are finished, click on the **[Close]** button.

The new standards will appear as a plot series, under the Plots node in the tree. You can then modify the line, symbol and label properties, as shown below:



Line

Visible: show/hide the line

Width: set the line width

Color: specify the line color

Style: specify the line style (Solid, Dashed, etc.)

Marker

Visible: show/hide the markers

Font: Set the font for labels for the line markers

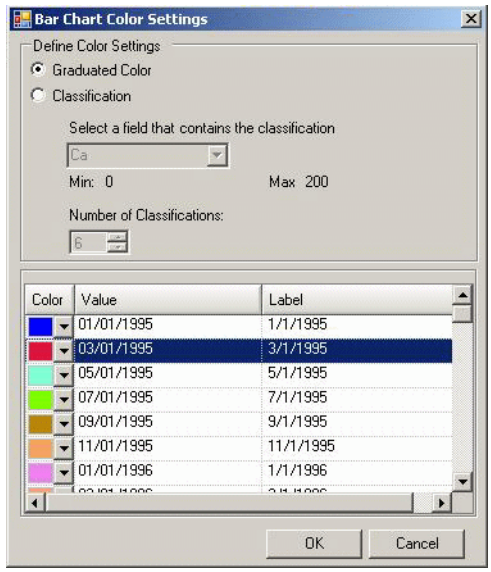
Color: specify the color

Size: Set the size of the markers along the line

Multiplier: select a field that contains a multiplier value; use this to apply a multiplier factor to all result values on the plot

Bar Color Schema: This option allows you to define advanced bar color settings for bar chart plots. When this option is loaded, the **Bar Chart Color Settings** dialog will display (shown below).

NOTE: This dialog will only be available after you have specified **Bar** as the **Series Type** in the Settings tab.

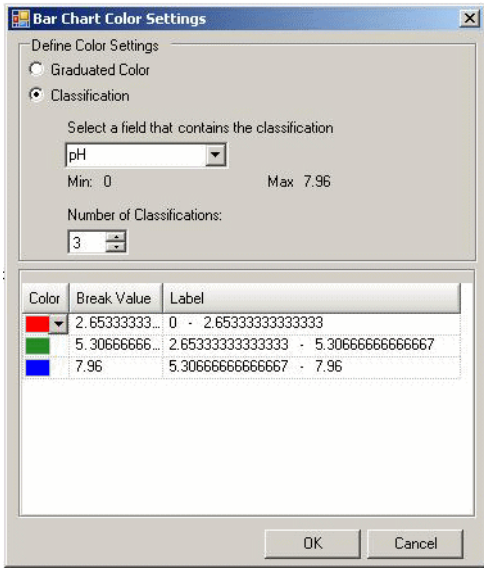


In this dialog you may define the color scheme by selecting the **Graduated Color** radio button or the **Classification** radio button. These options are most useful when displaying the charts on a map, in order to see both the trends in the data over time at a single sample location, and the spatial distribution/trends of all sample locations.

Graduated Color: This option allows for coloring bars from the same sample date, the same color on all bar charts. For example, if your plot data contains sample data from three seasonal sampling rounds (spring, summer, fall), you will see 3 instances in the grid at the bottom. A different color can be assigned to each sample date.

Upon clicking **[OK]**, each bar in the bar chart will be colored with the specified color, and all bar charts in the series will share the same color (where the sample date exists).

Classification: This option allows for coloring the entire bar chart a certain color, based on where it lies within a specified criteria. For this, you must provide a query that contains a field that will be used for the criteria identification. When you select this option, you must map to this field, and you will then see the min and max available for this field (as shown below). You can then define the number of classifications (default is 3), and the data range will be separated into equal number of parts. At this point, you can specify the color and the label.



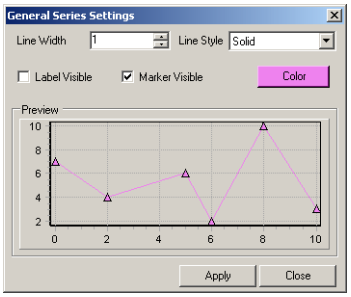
Upon clicking **[OK]**, the entire bar chart will be colored with the appropriate color, based on where it lies in this criteria

14.3 Plot Settings

Once a plot is selected and visible, there are several settings that can be modified. These settings are sorted into several groups explained below.

14.3.1 General Series Settings

Some of the most-frequently used, general plot settings are available when you *right*-mouse click on a plot window (that contains a data series), and select **Edit General Settings**. The following dialog will appear for line chart:



The following settings are available:

Line Width: specify the line width

Line Style: select the line style

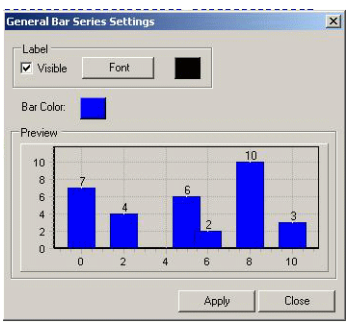
Labels Visible: show/hide the data marker labels

Markers Visible: show/hide the data markers

Color: specify the color for the line

As you define the series options, the **Preview** frame at the bottom of the dialog provides a live-update preview of how the data series will appear using the selected settings.

If you have selected Bar as the series type, the following dialog will appear:



In this dialog, you can modify the following settings:

Font: Specify the label font style, size and effects

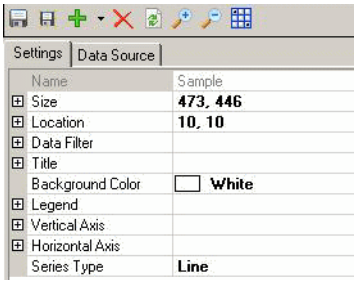
Visible: Show/Hide labels

Font Color: Specify the color of the label text

Bar Color: Specify the color of the bars

14.3.2 Style and Display Settings

Settings such as Axis, Line, and Legend can be modified in the **Settings** tab as shown below:



The following settings are available:

Common

Name: Enter the Plot name, and optionally specify a Background color

Size: Specify the Height and Width for the plot

Location (Origin): Specify the X, Y origin for the plot. The origin (0,0) is located in the upper left corner of the plot window.

Data Filter: Set a data filter for the plot data; this is useful when the plot contains a large number of data points, and you want to filter out repetitive or unnecessary data, or values where this is no significant change.

Active: Use this option to enable/disable the filter

Value: Set the filter value. Any consecutive plotted data points with a value less than this specified filter value will be hidden from the plots, when the filter is active.

Title: Enter a Title for the plot.

Legend

The following Legend settings are available:

Visible: Show/hide the legend

Alignment: Set the Legend position; choose from the following options:

- Top
- Bottom
- Left
- Right

Style: Controls what data elements or series appear in the Legend; choose from the following options:

- Automatic
- Series Names
- Series Values
- Last Values
- Palette

Vertical space: Controls the amount of vertical space between each data element in the legend; higher values will result in more space between each item in the legend.

Inverted Legend: Use this property to reverse the order of items in the legend. For example, items in the order A, B, C, will be inverted to the order C, B, A, when this property is selected.

Check boxes visible: Use this property to display a check-box beside each item in the legend; when active, you can then use the Legend check boxes to show/hide which data series are visible on the plot.

Font series color visible: Controls the font color for the text in the legend.

Vertical (Y) Axis

Pen width: Controls the thickness of the axis line

Visible: Shows/hides the axis on the plot

Log scale: Plots the axis values using a logarithmic scale

Max value: Controls the maximum value for the axis. By default, this value will be calculated from the selected data set

Min value: Controls the minimum value for the axis. By default, this value will be calculated from the selected data set

Auto max value: Restores the default automatic maximum value, which is calculated from the selected data set.

Auto min value: Restores the default automatic minimum value, which is calculated from the selected data set

Grid

Visible: Shows/hides gridlines on the plot

Style: Controls the grid line style; select from Solid, Dash, Dot, DashDot, or DashDotDot

Title

Text: Sets the title for the axis

Visible: Shows/hides the axis title

Angle: Controls the angle for the axis title; for the Y axis, it may be useful to have the angle set at 90 degrees.

Font: Controls the font for the axis title

Tick Label

Format: Controls the decimal format for the labeled tics; enter #.00 to display 2 decimal places, to display no decimal places, simply enter 0

Angle: Controls the angle for the tick labels; for date labels, it may be useful to select an angle of 45 or 90 degrees for improved display

Font: Controls the font for the tick labels

Horizontal (X) Axis

The Settings for the X Axis are identical to the Y axis, with the following exceptions:

- Log Scale is not available
- Min and Max values: when you define the min and max format, you must select these values from a calendar
- You can specify a **Date/Time format** from the following options:
  - m/d/yyyy
  - MMM/yyyy
  - MM/yyyy
  - yyyy
  - MMM
  - hh:mm:ss tt (tt = AM/PM)
  - hh:mm:ss
- You can set the **Tick Interval** by selecting one of the following options:
  - Min
  - Hour
  - Day
  - Month
  - Year

Series Type

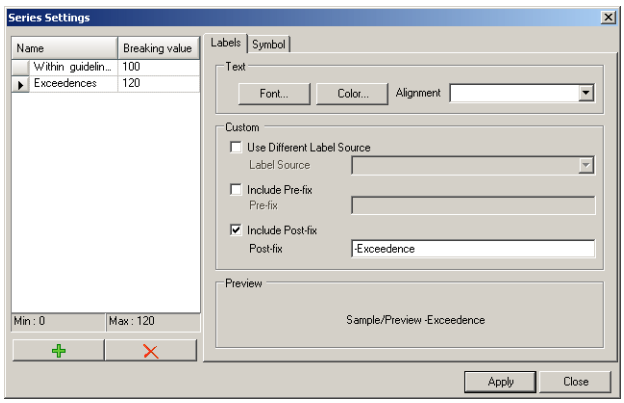
Line: displays the plot as a line chart.

Bar: displays the plot as a bar chart.

NOTE: You can also change the Series Type by right-clicking on any data point on and plot, and selecting **Change Series Type**.

14.3.3 Data Series Settings

Data Series (Range) settings can be accessed by *right*-mouse clicking on any data point on the plot, and selecting **Edit Range Settings** from the pop-up menu. The following **Series Settings** dialog will appear:



On the left side of this dialog, there is a list of available data series for the selected plot. You may also Add Data Range series, and specify Data Series options for this Series. This is useful if you want to identify data on the plot that exceeds a guideline or standard value, and assign unique symbol or label properties to this data set only.

- Click on the (Add) button to add a new range
- Click on the (Delete) button to delete the selected range

When you add a new Range, enter the **Breaking Value**; this is the upper limit for the range. For the example shown in the screenshot above, there will be two ranges:

- **Within guidelines**: Values 0 - 100 (inclusive) will have unique symbol and label properties
- **Exceedences**: Values greater than 100 to 120 (inclusive) will have a different set of symbol and label properties, so they can easily be distinguished on the plot

The **Labels** provides options for the data series labels:

Text: Select the Font, Color and Alignment options for the text.

Custom: There are several options available for defining custom label.

> **Use different label source** allows you to select a field from the list, for the labels from a list.

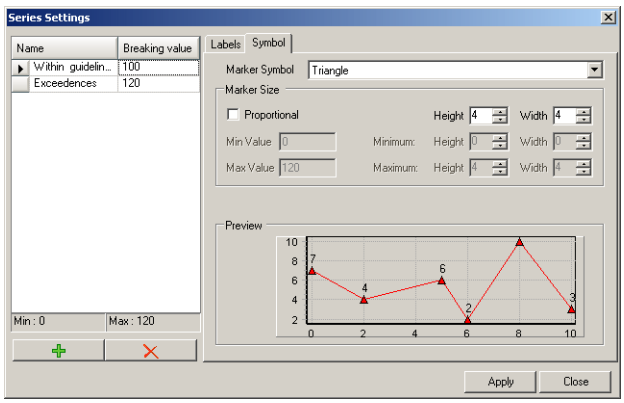
Include pre-fix provides the option to attach a text string in front of each label

Include post-fix provides the option to attach a text string at the end of each label

NOTE: If the Label options are inactive, you must set the Labels to Visible; load the **General Series Settings**, and enable the Labels Visible option.

As you define the label options, the **Preview** frame at the bottom of the dialog provides a live-update preview of how the data series labels will appear using the selected settings.

When you are finished with the Label options, you can click on the **Symbol** tab to modify the symbol options as shown in the screenshot below:



The following settings are available:

Symbol marker: select the symbol marker type from the combo box

Marker Size

Height: specify the symbol height

Width: specify the symbol width

Proportional: use this option to create proportionally sized symbols, dependent upon the result value

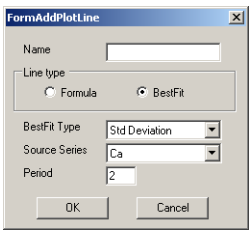
Min value: specify the min value for the smallest symbol size; then specify the marker size (Height and Width) that should correspond to this value

Max value: specify the max value for the largest symbol size; then specify the marker size (Height and Width) that should correspond to this value

As you define the label options, the **Preview** frame at the bottom of the dialog provides a live-update preview of how the data series symbols will appear using the selected settings.

14.4 Adding Lines to a Plot

Best fit lines, or lines calculated with user-defined formulas, can be displayed on any plot; to do so, *right*-mouse clicking on any data point on the plot, and selecting Add Line from the pop-up menu. The following **Add Line** dialog will appear:



Enter a line **Name** at the top of the dialog; this name will appear on the plot.

The following **Line Types** are available:

- Formula
- Best Fit

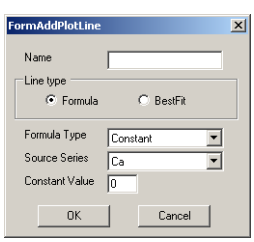
Best Fit is the default line type; when selected, the following settings are available:

Best Fit type: select from Std Deviation, Moving Average, or Exponential Moving Average

Source Series: select the data source series to which the line should be applied

Period: enter a period value

When the **Formula** line type is selected, the following settings will be available:



Formula type: select from Constant, Exponential, Logarithmic, or Inverse

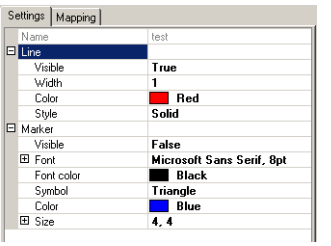
Source Series: select the data source series to which the line should be applied

Constant Value: When a Constant Formula Type is selected, enter a constant value for the location of the line. This will result in a straight line drawn on the plot.

Click **[OK]** when you are finished, to draw the new line on the plot. The line series will appear in the tree under the selected plot. The line settings can be modified as described below.

Line Settings

When a line is selected for a plot, the **Settings** tab will display the appropriate Line Settings as shown below:



Name: set the line name

Line

Visible: show/hide the line

Width: set the line width

Color: specify the line color

Style: specify the line style (Solid, Dashed, etc.)

Marker

Show / hide markers on the line using the **Visible** option

Font: Set the font for labels for the line markers

Color: specify the color

Size: Set the size of the markers along the line

14.5 Saving and Exporting

There are several options available for saving, exporting, and printing your plot page design.

14.5.1 Saving Plot Page Design

Once you are satisfied with the current plot page design, click on the (Save) button on the toolbar. The new plot will appear under the **Plots** node in the HGA tree.

14.5.2 Saving Plot as Template

Once you have designed the current plot to your style and data needs, you can save the design as a template for re-use in future plots. To do so:

☞ *Right*-mouse click on **Plots**, and select **Save as a plot template** from the menu

Enter a name for the plot template and

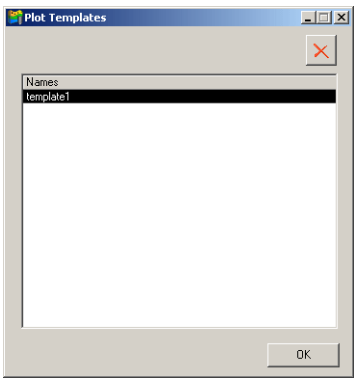
☞ **[OK]**

The template will be available next time you create a new plot, in the **Add Plot** dialog under the **Templates** combo box.

Deleting Plot Templates

Plot templates can be deleted from the main HGA window.

Right-mouse click on **Plots** in the HGA project browser (tree) and select **Plot Templates**. The following dialog will appear:



Select the template you want to remove, then click on the (Delete) button at the top of the window.

14.5.3 Export Plot Page to Graphics File

To export the current plot page design, *right*-mouse click on the plot page design node in the tree, and select **Export Plot Page to Image** from the pop-up menu. The image can be saved to the following graphics file formats:

.BMP, .JPG, .TIF, .EMF, .GIF, .PNG

Enter a filename, and choose the file format, and click Save.

14.5.4 Copy Plot to Clipboard

This option is available for individual plots in the design. To copy the selected plot, to the windows clipboard, *right*-mouse click on the plot name in the tree, or *right*-mouse click on the plot in the viewer, and select **Copy to Windows Clipboard** from the pop-up menu. You can then insert the plot into a graphics or word processing application for further modifications.

14.5.5 Export Plot Page to Document

To export the current plot page design, right-mouse click on the plot design in the tree, and select Export from the pop-up menu. The plot page design can be saved as an .XML file.

14.5.6 Printing

Click on the **[Print]** button in the lower-right corner to send the current plot view to your printer.

Appendices

15.1 Appendix A: HydroGeo Analyst File Types

HydroGeo Analyst uses two types of files to manage users settings of the software and the projects its managing. The first file named as ***HGB.WHI*** is used to store general user settings for the software. The second file ***"Project.VBH"*** is used to store general information about your project. This file stores the project identification and information about the location of your database and the necessary settings for connection.

Each one of these data files must remain in the same directory as they are originally created. These files are listed below, where *projectname* is the name assigned to the project. A description of the content of each file is given below.

15.1.1 HydroGeo Analyst - Main Module

projectname.**HGA**
projectname.**UDL**
projectname.**WHI**
History.**XML**

15.1.2 Map Manager

projectname.**VMP**
projectname.**ALS**
projectname.**BPW**
mapname.**DXF**
mapname.**BMP, .JPG, etc.**
projectname.**WDL**
projectname.**MAP**
projectname.**LYR**
projectname.**DBF**
projectname.**PRJ**
projectname.**SHP**
projectname.**SHX**
projectname.**XML**

15.1.3 Cross Section Editor

projectname.**VCP**
projectname.**DBF**
projectname.**SHP**
projectname.**SHX**
projectname.**XML**

15.1.4 3D Explorer

projectname.**3XS**
projectname.**BPW**
projectname.**BMP**

15.1.5 Reports

*projectname.***WRP**
*projectname.***WTP**
*projectname.***RDF**
*projectname.***RPX**
*projectname.***TPX**
*projectname.***XML**

15.2 Appendix B: Project Files and Directory Structure

An HGA project consists of many different files and folders related to the different components within HGA. Please refer to the information below to determine what data is stored in which folder:

ProjectDirectory

- Root
- Map
  - *Data*
  - *Selection*
- Plumes
- Surfaces
- V3D
- XSection
  - *XS1*
    - *XInter*
    - *bhlp*
  - XS2
  - …

Root:

Project.vbh is a text file and contains the information on the connection string to the HGA project, such as SQL server name, database catalog name, etc.

Project.vbh.bak is a backup of the .vbh file.

Map:

The map folder contains all of the shapefiles associated with the map project. In the root, you will find **MapProjectName.VMP**. This is an XML file that contains details on the map project, such as the projection system, renderers, settings, cross-section lines, intersections, etc. Each map project has a unique .VMP file.

Selection

When you create a new map layer from an HGA station group (or selected stations), a new points shapefile is created and saved in this directory (i.e. boreholes.shp, boreholes.shx, boreholes.dbf).

Data

When you create a new map layer from an HGA data query, or a map project, a new points shapefile is created and saved in this directory. (e.g. Chem_Exceedences.shp, Chem_Exceedences.shx, Chem_Exceedences.dbf)

Plumes:

The plumes folder contains all of the files associated with the plume data once the 3D interpolation has been conducted on a query. The created .nc files are used when viewing the plumes in the 3D Explorer.

Surfaces:

The surfaces folder contains all of the gridded surfaces (.GRD files) created in the map project by interpolating the current layer. The gridded surfaces can also be used in the 3D Explorer.

V3D:

The V3D folder contains all of the 3D Explorer project files. Any saved scene configurations will also be located in this folder.

- **Name.3XS**: This is the 3D Explorer project file. XML file format
- **.BMP**: any map image sent from the map project will be saved in bitmap format (.bmp).
- **.BPW**: any bitmaps tagged with georeference details.

XSection:

The xsection folder contains all of the cross-section information from your project. In the xsection folder there is a subfolder for each cross-section created in the project (i.e. AA, BB, etc.). The subfolders contain all the shapefiles associated with the cross-section.

XInter

The XInter subfolder contains the shapefiles from the map project for the cross-section line.

BHLP

The BHLP subfolder contains image files for any borehole log plots drawn on the cross-section. BHLP images are saved as .EMF format.

15.3 Appendix C: Using the Data Link Properties for Importing

The Microsoft Data Link Properties dialog appears throughout HydroGeo Analyst, whenever an option to import data or entities, or “Build a connection string” exists. A few examples are:

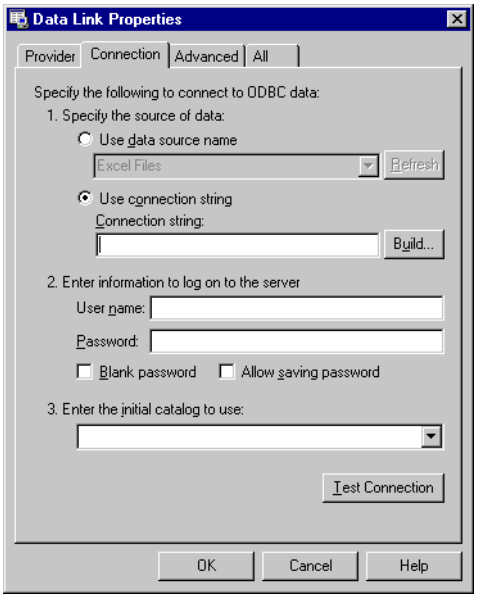
- Importing lists in the List Editor
- Importing tables in the Template Manager

The following section describes briefly an example of how to Build a connection string, and import an Excel file, using the Data Link Properties. For more details, please refer to the context sensitive Help buttons in this module.

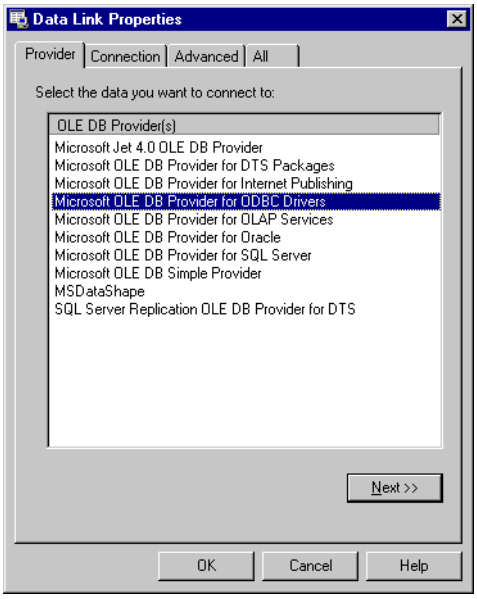
The example below applies to importing a list of fields in the template manager, from an excel file.

To load the Data Link Properties window:

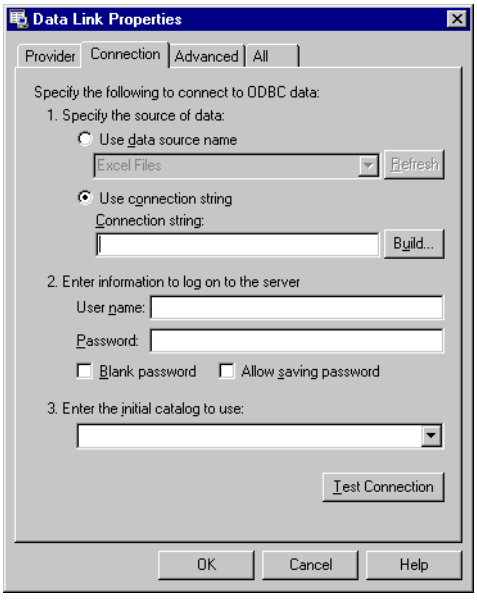
- Click on the Build Connection String button . The following dialog will appear:



- From the top of this dialog, click on the Provider tab, as shown below.


Data Link Properties
Provider
Connection
Advanced
All
Select the data you want to connect to:
OLE DB Provider(s)
Microsoft Jet 4.0 OLE DB Provider
Microsoft OLE DB Provider for DTS Packages
Microsoft OLE DB Provider for Internet Publishing
Microsoft OLE DB Provider for ODBC Drivers
Microsoft OLE DB Provider for OLAP Services
Microsoft OLE DB Provider for Oracle
Microsoft OLE DB Provider for SQL Server
Microsoft OLE DB Simple Provider
MSDataShape
SQL Server Replication OLE DB Provider for DTS
Next >>
OK
Cancel
Help

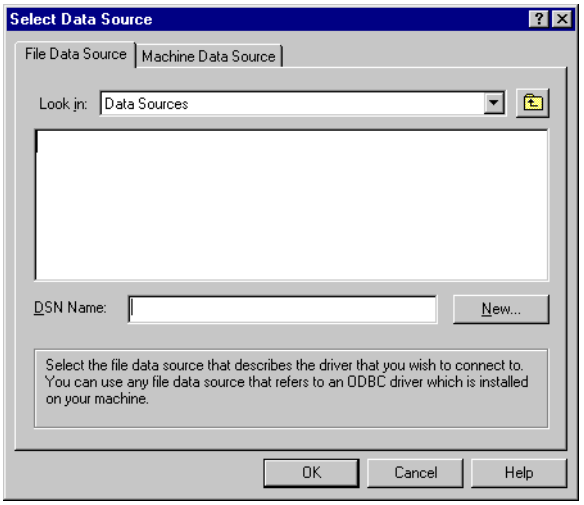
- Select the Provider option. For this example, select Microsoft OLE DB Provider for ODBC Drivers (this option allows you to choose from such sources as Text, Excel, or Access).
- Click on the Connection tab once more, to display the original dialog.



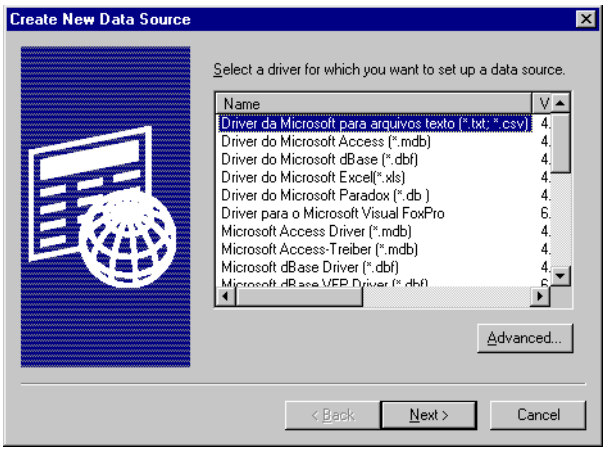
- Under the “Specify the source of data”, select the option “Use Connection

String".

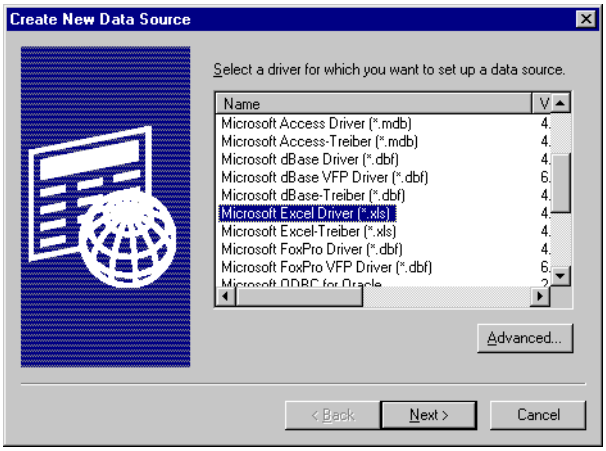
- Click on the [Build] button, and the following dialog will appear:


Select Data Source
File Data Source
Machine Data Source
Look in:
Data Sources
DSN Name:
New...
Select the file data source that describes the driver that you wish to connect to. You can use any file data source that refers to an ODBC driver which is installed on your machine.
OK
Cancel
Help

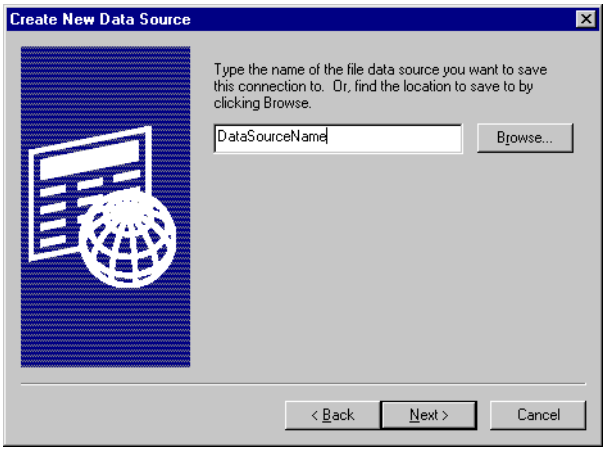
- In this dialog, select from a list of data sources. Since none are available, click on the [New] button to create a new one. The following dialog will then appear.


Create New Data Source
Select a driver for which you want to set up a data source.
Name
Driver da Microsoft para arquivos texto (*.txt; *.csv)
Driver do Microsoft Access (*.mdb)
Driver do Microsoft dBase (*.dbf)
Driver do Microsoft Excel(*.xls)
Driver do Microsoft Paradox (*.db)
Driver para o Microsoft Visual FoxPro
Microsoft Access Driver (*.mdb)
Microsoft Access-Treiber (*.mdb)
Microsoft dBase Driver (*.dbf)
Advanced...
< Back
Next >
Cancel

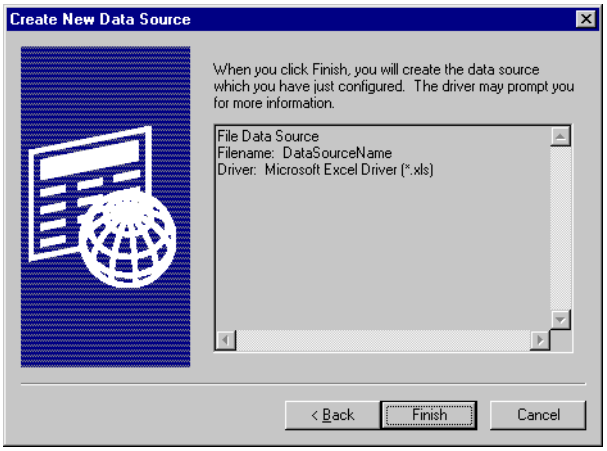
- Select the ODBC driver format. In this example, select Microsoft Excel Driver, as shown below:



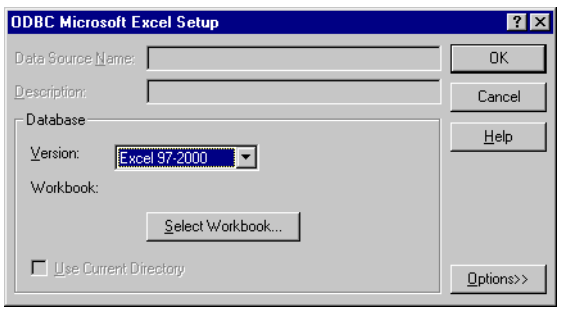
- Click [Next] to proceed, and the following dialog will appear.


Create New Data Source
Type the name of the file data source you want to save this connection to. Or, find the location to save to by clicking Browse.
DataSourceName
Browse...
< Back
Next >
Cancel

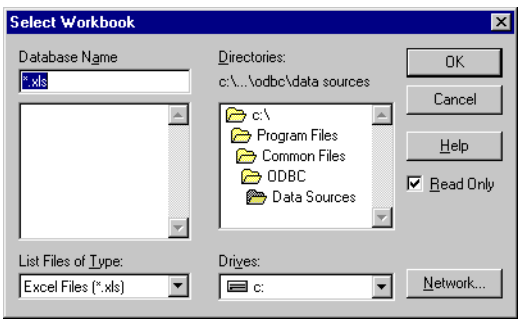
- In this dialog, enter a name for the new Data Source in the Name field.
- Click [Next] to proceed.


Create New Data Source
When you click Finish, you will create the data source which you have just configured. The driver may prompt you for more information.
File Data Source
Filename: DataSourceName
Driver: Microsoft Excel Driver (*.xls)
< Back
Finish
Cancel

- This dialog displays a summary of the data source information.
- Click [Finish] to close the dialog, and the following ODBC Setup dialog will appear.

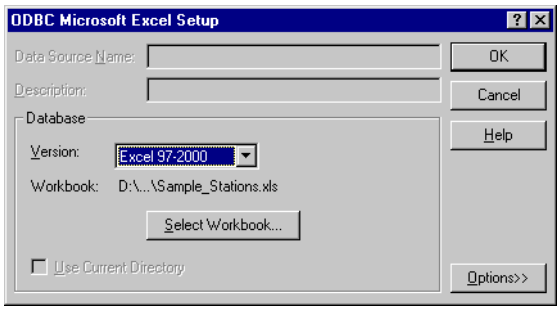


- In this dialog, select the Excel version from the combo box.
- Press the [Select Workbook] button, and the following dialog will appear:

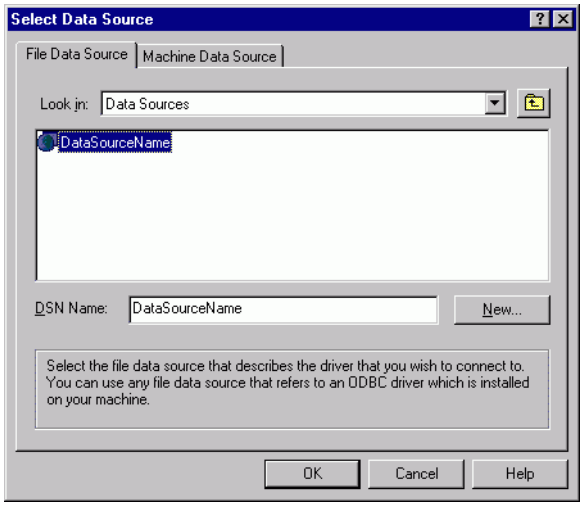


- From this dialog, browse to the drive and directory that contains the source file.

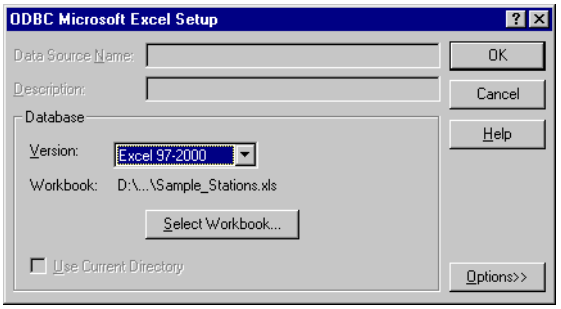
- Click [OK] to select this file.
- A confirmation dialog will appear listing the Excel format and filename as shown below.



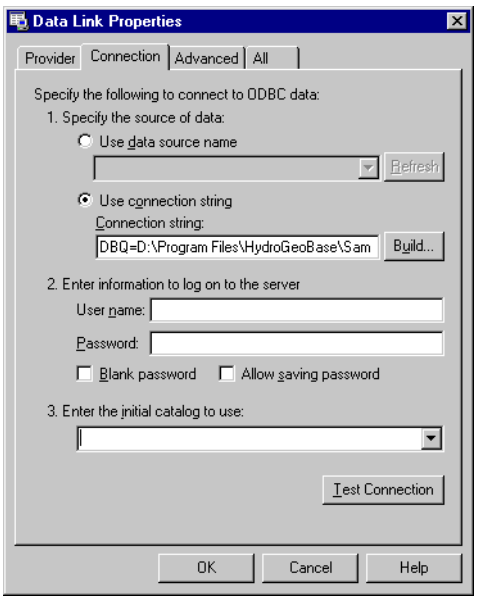
- Click [OK] to proceed.


Select Data Source
File Data Source
Machine Data Source
Look in:
Data Sources
DataSourceName
DSN Name:
DataSourceName
New...
Select the file data source that describes the driver that you wish to connect to. You can use any file data source that refers to an ODBC driver which is installed on your machine.
OK
Cancel
Help

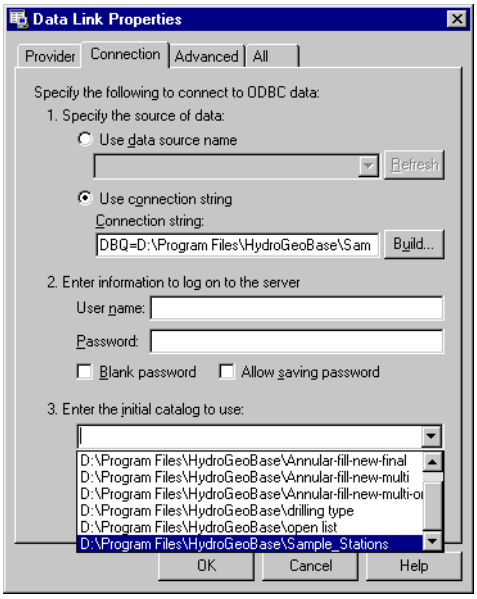
- Select the DataSourceName that was created.
- Click [OK] to proceed.



- Click [OK] again to proceed.
- The main Data Link Properties dialog will appear once more. The connection string to the data source will now appear in the connection string field, as shown below.



- Next, you must select the “initial catalog to use”, from the bottom of the Connection tab, as shown in the figure below.



- Select the Excel file once more.
- Click [OK] to complete the procedure.
- The file will then be loaded into the appropriate module in HydroGeo Analyst.

15.4 Appendix D: Advanced Interpolation Settings

15.4.1 Inverse Distance

The Inverse Distance Squared method is a very fast and efficient, weighted average interpolation method. The weighting factor applied to the data depends on the distance of the point from the grid cell, and is inversely proportional to the distance squared. Consequently, the greater the distance the data point is from the grid node, the smaller the influence it has on the calculated value.

The Inverse Distance Squared method for interpolation may generate patterns similar to a “bull’s-eye” surrounding points of observations. Selecting a larger number of nearest neighboring data points may smooth this effect, but if the bull’s eye pattern is undesirable, then other methods of interpolation, like Natural Neighbor and Kriging, are recommended.

The **Interpolator Options** for the Inverse Distance Squared method is described below.

Start X	Minimum X co-ordinate for the interpolation grid.
End X	Maximum X co-ordinate for the interpolation grid.
X_Nodes	Number of grid nodes in the X-direction.
Start Y	Minimum Y co-ordinate for the interpolation grid.
End Y	Maximum Y co-ordinate for the interpolation grid.
Y-Nodes	Number of grid nodes in the Y-direction.
Use Log Interpolation	Flag to interpolate the log values of the data. This setting is useful for where some measured values are many orders of magnitude higher than the majority of the other values. In such cases, the large values dominate the interpolation process and details in the low concentration zones are removed. If this setting is selected, the log of each data value is taken prior to performing interpolation. By interpolating the log of the data set, small values are given more weight than otherwise.
Restrict Min Value	Flag to restrict the minimum value of the interpolated data.
Restrict Max Value	Flag to restrict the maximum value of the interpolation data.
Value Min	Minimum value of the interpolated data. Any interpolated data less than **Value Min** will be assigned a value of **Value Min**.
Value Max	Maximum value of the interpolated data. Any interpolated data greater than **Value Max** will be assigned a value of **Value Max**.
Real Min	Real minimum value of interpolated data.
Real Max	Real maximum value of interpolated data.

Num_Neighbors	Number of nearest data points to use when calculating interpolated value for each grid node.
Z_Only	Allows the user to select between outputting the original X and Y values, plus the interpolated value (x,y,f(x,y)), or the interpolated value only (f(x,y)). **Note**: This has no effect on the actual contour output, and can be ignored.

15.4.2 Natural Neighbor

The Natural Neighbor method (Watson, 1994) is based on the Thiessen polygon method used for interpolating rainfall data. The grid node for interpolation is considered a new point, or target, for the existing data set. With the addition of this point, the Thiessen polygons based on the existing points are modified to include the new point. The polygons reduce in area to include the new points, and the area that is taken out from the existing polygons is called the “borrowed area”. The interpolation algorithm calculates the interpolated value as the weighted average of the neighboring observations where the weights are proportional to the borrowed areas. The Natural Neighbor method is valid only with the convex hull of the Thiessen polygon formed by the data points, and values outside the hull extrapolation should be used with caution.

The Natural Neighbor interpolation scheme may be visualized as a taut rubber sheet stretched to satisfy all the data points. The interpolated value at any location is a linear combination of all Natural Neighbors of that location, and the resulting surface is continuous with a slope that is also continuous. Combining the gradients or slopes with the linear interpolation provides results that are more smooth, and may anticipate the peaks and valleys between data. Singularities and other undesirable effects may be lessened by incorporating the gradient factor.

The gradient influence on the results can be manipulated by two tautness parameters that the user can enter. These parameters allow the interpolated surface to vary from purely linear interpolation to one which is well rounded and has the gradient factor. In all cases the slope discontinuities are removed and the resulting surface has slope continuity everywhere.

The advanced settings parameters for the Natural Neighbor method are described below:

Start X:	Minimum X co-ordinate for the interpolation grid.
End X:	Maximum X co-ordinate for the interpolation grid.
X_Nodes:	Number of grid nodes in the X-direction.
Start Y:	Minimum Y co-ordinate for the interpolation grid.
End Y:	Maximum Y co-ordinate for the interpolation grid.
Y-Nodes:	Number of grid nodes in the Y-direction.

Use Log Interpolation: Flag to interpolate the log values of the data. This setting is useful for where some measured values are many orders of magnitude higher than the majority of the other values. In such cases, the large values dominate the interpolation process and details in the low concentration zones are removed. If this setting is selected, the log of each data value is taken prior to performing interpolation. By interpolating the log of the data set, small values are given more weight than otherwise.

Restrict Min Value: Flag to restrict the minimum value of the interpolated data.

Restrict Max Value: Flag to restrict the maximum value of the interpolation data.

Value Min: Minimum value of the interpolated data. Any interpolated data less than Value Min will be assigned a value of Value Min.

Value Max: Maximum value of the interpolated data. Any interpolated data greater than Value Max will be assigned a value of Value Max.

Real Min: Real minimum value of interpolated data.

Real Max: Real maximum value of interpolated data.

Mag_X: X co-ordinate magnification factor

Mag_Y: Y co-ordinate magnification factor

Mag_Z: Z co-ordinate magnification factor

No_Value: Value assigned to nodes located outside the convex hull of the data points (where interpolation is not performed)

Allow_Extrapolation: Is a flag to use extrapolation for nodes outside the convex hull of the polygon formed by the data points. In this case linear regression is used to fit a plane through the data set and calculate the interpolated value. This should be used with caution since extrapolation is less reliable than interpolation.

Sdip: Calculate the aspect and slope at each grid node. This can be used to augment the elevation information. The aspect is measured in degrees or radians clockwise from north, and the slope is measured positively below the horizontal plane in degrees or radians.

Tautness_1: Controls the influence of the gradient on the results and may be used to smooth the interpolated surface.

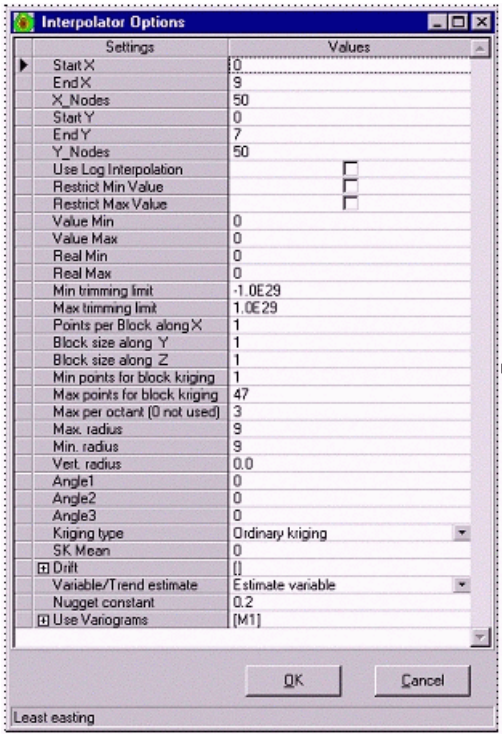
Tautness_2: Controls the influence of the gradient on the results and may be used to smooth the interpolated surface.

Use_Gradient: Blends the gradient calculation and the linear interpolation calculation to produce a smoother surface.

15.4.3 Kriging

Kriging is a geostatistical method that produces visually appealing maps from irregularly spaced data. Anisotropy and underlying trends suggested in raw data can be incorporated in an efficient manner through Kriging. The program used, called **kt3d**, is available in the public domain from the Geostatistical Software Library (GSLIB), distributed by Stanford University, and is well-documented by Deustch and Journel (1998). The program **kt3d** from GSLIB performs simple Kriging, ordinary Kriging, or Kriging with a polynomial trend, and uses the standard parameter file used by GSLIB. If the semi-variogram components have already been modeled by the user, they can be incorporated into the program by choosing the appropriate set of parameters in the parameter file. The semi-variograms available include Spherical, Exponential, Gaussian, Power, and the Hole effect models. If the variogram information is not available, the default linear variogram with no nugget effect should be used. This option is a special case of the Power model with the exponent equal to 1.

The **Interpolator Options** window for the Kriging method is shown in the following figure, while each of the settings parameters is described below



Start X	Minimum X co-ordinate for the interpolation grid.
End X	Maximum X co-ordinate for the interpolation grid.
X_Nodes	Number of grid nodes in the X-direction.
Start Y	Minimum Y co-ordinate for the interpolation grid.
End Y	Maximum Y co-ordinate for the interpolation grid.
Y-Nodes	Number of grid nodes in the Y-direction.
Use Log Interpolation	Flag to interpolate the log values of the data. This setting is useful for where some measured values are many orders of magnitude higher than the majority of the other values. In such cases, the large values dominate the interpolation process and details in the low concentration zones are removed. If this setting is selected, the log of each data value is taken prior to performing interpolation. By interpolating the log of the data set, small values are given more weight than otherwise.
Restrict Min. Value	Flag to restrict the minimum value of the interpolated data.
Restrict Max. Value	Flag to restrict the maximum value of the interpolation data.
Value Min.	Minimum value of the interpolated data. Any interpolated data less than **Value Min.** will be assigned a value of **Value Min**.
Value Max.	Maximum value of the interpolated data. Any interpolated data greater than **Value Max.** will be assigned a value of **Value Max**.
Real Min.	Real minimum value of interpolated data.
Real Max.	Real maximum value of interpolated data.
Min. Trimming Limit	Minimum bound for the interpolated data if the **Restrict Min. Value** option is not selected by the user.
Max. Trimming Limit	Maximum bound for the interpolated data if the **Restrict Max. Value** option is not selected by the user.

The **Points per block along X**, **Points per block along Y**, and **Points per block along Z** values allow the user to choose Block Kriging used for interpolation, as compared to Point Kriging. Block Kriging is based on the premise that since Kriging is a linear algorithm, direct estimation of the block average is possible for user-defined blocks. The default values for these parameters are 1, and in this case the default method is Point Kriging. If Block Kriging is being used, the user needs to enter the **Min. points for block Kriging** and **Max. points for block Kriging**.

The Octant Search option is an exhaustive search option available to make sure that data are taken on all sides of the point being estimated, and is especially recommended for 3D data. If the user specifies **Max. points per octant** to be greater than 0, an Octant Search is employed to find the neighborhood of points for interpolation.

The **Max. radius** and **Min. radius** defines the search distances, in user specified units, in the maximum horizontal direction and the minimum horizontal direction for determining the neighborhood of points for interpolation. For isotropic data, the two radii are the same. Enter the **Vertical Radius** value if 3D Kriging is to be performed. If the total number of points in the data is large (>200), computation time for Kriging may be reduced by specifying a smaller radius for the search.

The **Angle1**, **Angle2**, and **Angle3** parameters define the search ellipsoid for situations in which anisotropy is present in the data.

The **Kriging type** options are

- **Stationary simple Kriging with SK mean**
- **Ordinary Kriging**
- **Nonstationary simple Kriging with means from an external file**
- **Kriging with external drift**

The following guidelines are recommended for selecting the type of Kriging.

Choose **Stationary simple Kriging with SK mean**, if the mean value is known and is constant throughout the area.

Select **Ordinary Kriging** if the mean is not constant everywhere, and needs to be recalculated dependent on the location of the neighborhood.

Choose **Nonstationary simple Kriging with means from an external file** if the mean is not constant and has to be read from an external file.

Select **Kriging with an external drift** when only the trend component needs to be estimated, and not the residual component, where the variable is assumed to be the sum of the trend and the residual component. This option is also referred to as Universal Kriging.

For most situations, **Ordinary Kriging** is recommended and is the default option.

The **SK Mean** defines the global mean of the data if **Stationary simple Kriging** is performed.

The **Drift** term defines the drift components if **Kriging with external drift** is performed. Nine drift components are possible:

- X = linear drift in x
- Y = linear drift in y
- Z = linear drift in z
- Xq = quadratic drift in x
- Yq = quadratic drift in y
- Zq = quadratic drift in z
- XY = cross quadratic drift in xy
- XZ = cross quadratic drift in xz
- YZ = cross quadratic drift in yz

The **Variable/Trend Estimate** allows the user to choose between estimating the variable or the trend. The default is **Estimate variable**.

The **Nugget** constant quantifies the sampling and assaying errors in the data. In a Variogram plot the nugget constant is the y-intercept value.

The **Use variograms** option allows the user to select the type of variogram to be used. The Variogram models available include:

- **Spherical**
- **Exponential**
- **Gaussian**
- **Power**
- **Hole Effect**

If the variogram information is not available, the default linear variogram with no nugget effect should be used. This option is a special case of the **Power** model with the exponent equal to 1.

15.5 Appendix E: Map Manager: ISO Codes

None

1250: ANSI Central Europe, Latin 2

1251: ANSI Cyrillic, Slavic

1252: ANSI Latin 1

1253: ANSI Greek

1254: ANSI Latin 5, Turkish

1255: ANSI Hebrew

1256: ANSI Arabic

1257: ANSI Baltic Rim

1258: ANSI Vietnamese

437: OEM US, Latin

708: OEM Arabic, ASMO 708

720: OEM Arabic, Transparent ASMO

737: OEM Greek, formerly 437 G

775: OEM Baltic

850: OEM Western Europe, Latin 1

852: OEM Central Europe, Latin 2

855: OEM Russian, IBM; Cyrillic

857: OEM Turkish, IBM

860: OEM Portuguese, MS-DOS

861: OEM Icelandic, MS-DOS

862: OEM Hebrew

863: OEM Canadian Frech, MS-DOS

864: OEM Arabic

865: OEM Nordic, MS-DOS

866: OEM Russian, MS-DOS; Cyrillic II

869: OEM Greek 2, IBM Modern Greek

8859-1: ISO Latin 1; West European-Danish, Dutch, English, Faeroes, Finnish, French, German, Icelandic, Irish, Italian, Norwegian, Portuguese, Spanish, Swedish

8859-2: ISO Latin 2; East European-Albanian, Czech, English, German, Hungarian, Polish, Rumanian, Serbo-Croatian, Slovak, Slovene

8859-3: ISO Latin 3; Southeastern European-Afrikaans, Catalan, Dutch, English, Esperanto, German, Italian, Maltese, Spanish, Turkish

8859-4: ISO Latin 4; North European

8859-5: ISO English & Cyrillic-Based; Bulgarian, Byelorussian, English, Macedonian, Russian, Serbo-Croatian, Ukrainian

8859-6: ISO Arabic

8859-7: ISO English & Greek

8859-8: ISO Hebrew

8859-9: ISO Latin 5; Western European & Turkish

8859-13: ISO Latin 6; Lativan and Lithuanian

ANSI: Uses the system code page

OEM: Uses the OEM equivalent of the system code page

ISO: Uses the ISO equivalent of the system code page

BIG5: Uses the ANSI 950 code page, also known as Big5; Chinese Taiwan, HongKong SAR, PRC

SJIS: Uses the ANSI 932 code page, also known as Shift-JIS; Japanese

EUC: Uses the EUC(ISO) equivalent of the system code page

15.6 Appendix F: Online GIS Data Resources

U.S Bureau of the Census

http://www.esri.com/data/download/census2000_tigerline/
Data: Census 2000 TIGER/Line Data
Format: Shapefile
Geographic Coverage: United States, Puerto Rico, U.S Virgin Islands, American Samoa, Guam, The Commonweath of Northern Mariana Islands, and the Midway Islands
Datum: NAD 83
Layer: Roads, Railroads, Rivers, Lakes, Legal boundaries, Census Statistical Boundaries etc.

NASA

ftp://e0srp01u.ecs.nasa.gov/srtm/
Data*:* Shuffle Radar Topography Mission (SRTM)
Format*:* Raster (SRTM)
Geographic Coverage*:* Global, SRTM1 (30m) for USA, SRTM3 (90m) World
Datum*:* WGS84/NAVD88
Layer*:* DEM

Natural Resources Canada

http://geogratis.cgdi.gc.ca/download/
Data: CGDI Warehouse
Format: Vector and Raster
Geographic Coverage: Canada
Datum: Various
Layer: Landsat, RADARSAT, Canada Atlas, Canadian Geographic Information Systems (Land Use), National Scale Frameworks, Census Data; Ontario Land use Cover, Canadian Conversation Areas Database, State of Canada's Ecosystem.

CGIAR Consortium for Spatial Information (CGIAR-CSI)

http://srtm.csi.cgiar.org/
Data: Shuttle radar Topography Mission (SRTM)
Format: Geotiff or Arcinfo
Geographic Coverage: Global (90M)
Datum: WGS84/EGM96
Layer: DEM

Global Land Cover Facility

http://glcfapp.umiacs.umd.edu:8080/esdi/index.jsp
Data: Land Sat. TM Images
Format: GeoTiff
Geographic Coverage: Global, Up to 30m
Datum: WGS84
Layer: Landover Images

Land Information Ontario

http://lioapp.lrc.gov.on.ca/lids/welcome.asp
Data: NRVIS Data
Format: Coverage
Geographic Coverage: Ontario, Canada
Datum: NAD83 CNT
Layer: Airport, Annotation, Building, To Scale, Building As Symbol, Concession, Contour, Crown Game Preserve; Drainage Line; Drainage Point; MNR District; MNR Region; Municipal Park, National Wildlife Area; OBM DTM; Park Zone Reg; Pit or Quarry; Provincial Park Zone Regulated; Railway Segment; Spot Height; Tank; Tower; Transport Line; Transport Point; Utility Line, Utility Site; Water Edge; Water Structure; Waterboy Segment; Wooded Area.

GeoCommunity

http://data.geocomm.com/catalog/
Data: GIS Data Depot
Format: e00 format (coverage)
Geographic Coverage: Each Country; USA, each State and County.
Layer: DEM, NWI, DLG, LU/LC, and TIGER are available for free.

United States Geological Survey

http://seamless.usgs.gov/
Data: GIS Data Warehouse
Format:
Geographic Coverage: World, each country; USA, any scale and seamless:
Datum: NAD83
Layer: US National Elevation Dataset (up to 10 M), National Land Cover Dataset, High Resolution Orthoimagery, Layer extent, Transportation, Boundaries, Hydrography.

Florida Department of Environment Protection

ftp://ftp.dep.state.fl.us/pub/gis/data
Data: GIS Data
Format: Shapefile
Geographic Coverage: Florida
Datum: FDEP custom Albers projection in the HPGN datum
Layer: Environmental Data, Basemap Data

Global Forest Watch Canada Warehouse

http://www.globalforestwatch.ca/datawarehouse/datawarehouse.htm
Data: GIS
Format: Shapefile, GRID, XLS
Geographic Coverage: Canada
Datum: North American Datum of 1927
Layer: Forest related data; basemap data

GeoPlan Center, University of Florida

http://www.fgdl.org/
Data: Florida Geographic Data Library (FGDL)
Format: Shapefile
Geographic Coverage: Floridawide and County
Datum: FDEP custom Albers projection in the HPGN datum
Layer: Various

St. Johns River Water Management District

http://sjr.state.fl.us/programs/data.html
Data: GIS data
Format: Shapefile and Raster
Geographic Coverage: St. Johns River Water Management District, Florida
Datum: NAD83
Layer: Basemap, Natural Resources and Images

United States Geological Survey and USA Environmental Protection Agency

http://nhd.usgs.gov/index.html
Data: National Hydrography Dataset
Format: Geodatabase
Geographic Coverage: USA
Layer: Surface water features such as lakes, ponds, streams, rivers, springs and wells

United States Environmental Protection Agency

http://www.epa.gov/OWOW/watershed/landcover/lulcmap.html
Data: Land Cover Digital Data
Format: Coverage
Geographic Coverage: USA Statewide
Layer: Satellite**,** Land Cover

National Atlas (USA)

http://www.atlas.usgs.gove/atlasftp.html
Data: National Atlas Map (Warehouse)
Format: Shapefile, Geotiff, DBF
Geographic Coverage: USA
Datum: NAD83
Layer: Agriculture, Biology, Boundaries, Climate, Environment, Geology; History, Map Reference, People, Transportation, Water.

United States Department of Agriculture

http://datagateway.nrcs.usda.gov/
Data: Natural Resources Data (Warehouse)
Format: Shapefile and Raster
Geographic Coverage: USA
Datum: NAD83
Layer: Orthoimagery, Soils, Common Land Units, Cultural and Demographics, Governmental Units and Place names, Elevation, Hydrography, Cadastral, Transportation (Roads), Digital Raster Graphic (DRG) Scanned USGS quads, Land Cover/Vegetation/Plants, Watershed boundaries (10-12 digit hydrologic units), Wetlands and Floodplain Easements, Climate - Precipitation and Temperature, Flood hazards, USDA Office Information Profile (OIP), Applied Conservation Practices, Water Control Infrastructure/National Inventory of Dams.

Grand River Conservation Authority

http://www.grandriver.ca/index/document.cfm?Sec=63&Sub1=16&sub2=0
Data: GRCA data
Format: Shapefile and Raster
Geographic Coverage: Grand River Watershed
Datum: NAD83
Layer: Airphoto, Topographic and Thematic Data

Ministry of Energy, Mines and Petroleum Resources, BC

http://www.em.gov.bc.ca/Mining/Geolsurv/MapPlace/geoData.htm
Data: Geology, Geochemistry
Format: Shapefile
Geographic Coverage: British Columbia
Datum: NAD83 and either BC Albers or Geographic (Decimal Degrees)
Layer: Geology, Geochemistry

Canadian Council on Geomatics

http://www.geobase.ca/geobase/en/index.html
Data: Geobase
Format: Shapefile and raster
Geographic Coverage: Canada
Datum: NAD83
Layer: Administrative Boundaries, DEM, Geodetic Network, Landsat, National Road Network

Ministry of Sustainable Resource Management, BC

http://srmwww.gov.bc.ca/gis/arcftp.html
Data: Warehouse
Format: Coverage, Raster
Geographic Coverage: British Columbia
Layer: Administrative Boundaries, Hydrology, Forest and more.

Alberta Geological Survey

http://www.ags.gov.ab.ca/mapserver/map236/download/download_gis.htm
Data: Geology, Geochemistry
Format: Shapefile
Geographic Coverage: Alberta
Datum: Geographic, NAD83
Layer: Geology

Alberta Community Development

http://www.cd.gov.ab.ca/preserving/parks/lrm/index.asp
Data: Parks and Protected Areas
Format: Shapefile
Geographic Coverage: Alberta
Datum: NAD83
Layer: Parks and Protected Areas

Department of Provincial Treasury

http://www.gov.pe.ca/gis/index.php3?number=77868
Data: Warehouses
Format: Shapefile and MIF (Mapinfo)
Geographic Coverage: Price Edward Island
Datum: NAD83
Layer: Administrative Boundaries, Road, Forest, Hydrology

Department of Natural Resources, Nova Scotia

http://www.gov.ns.ca/natr/meb/DOWNLOAD/UTMNAD83.htm
Data: Natural Resources Data
Format: Shapefile
Geographic Coverage: Nova Scotia
Datum: NAD83
Layer: Natural Resources

New York State GIS Clearinghouse

http://www.nysgis.state.ny.us/
Data: New York State GIS
Format: Shapefile and Raster
Geographic Coverage: New York State
Datum: NAD83
Layer: Provinces and territories, census divisions, economic regions, census metropolitan areas and census agglomerations, census consolidated subdivisions, census subdivisions.

Ontario Geological Survey

http://www.mndm.gov.on.ca/mndm/mines/ogs/draftbedrock_e.asp
Data: Digital version of the Paleozoic bedrock of Southern Ontario compilation map
Format: Geodatabase
Geographic Coverage: Ontario
Layer: Geology

Statistics Canada

http://www12.statcan.ca/english/census06/geo/index.cfm
Data: Road Network file; Boundary files for provinces and territories, census divisions, economic regions, census metropolitan areas and census.
Format: Shapefile
Geographic Coverage: Canada
Datum: NAD83

Layer: Road and Administrative Boundary

15.7 Appendix G: Frequently Asked Questions (FAQ's)

Waterloo Hydrogeologic Inc. maintains an online FAQ at the following internet address:

http://www.waterloohydrogeologic.com/FAQ/faq.htm

Please consult the FAQ website and the Help / User manual as your first resource. If you cannot find the answer, please contact technical support at Waterloo Hydrogeologic Inc. and they will be happy to assist you. You may contact WHI at:

Waterloo Hydrogeologic Inc.
460 Phillip Street - Suite 101
Waterloo, Ontario,
CANADA, N2L 5J2

Phone: +1 (519) 746-1798
Fax: +1 (519) 885-5262
E-mail: sws-support@slb.com
Web: www.waterloohydrogeologic.com

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